ENERGY SAVINGS OPPORTUNITY SURVEY
FORT MYER, ARLINGTON, VIRGINIA

SUMMER STEAM SHUT-DOWN STUDY

A/E CONTRACT NO.
DACA 31-89-C-0198

VOLUME I

Executive Summary

Prepared for

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT CORPS OF ENGINEERS
BALTIMORE, MARYLAND

By

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1. INTRODUCTION

Fort Myer is a permanent United States Army installation located in Arlington County, Virginia, on a site backing Arlington National Cemetery and overlooking the Potomac River and Washington, D.C. The installation consists of offices, family housing, Army Band facilities, supporting facilities, and barracks buildings including those known as the "Old Guard Barracks" which house soldiers that provide services at Arlington National Cemetery.

This report consists of the Summer Steam Shut Down Study of an Energy Savings Opportunity Survey (ESOS) at Fort Myer. The purpose of this study is to improve energy efficiency at Fort Myer by analyzing the effects and benefits of closing the central steam producing boiler facility, Building 447, during the non-heating months from mid-May to mid-October. Currently, the central steam plant operates through this period to provide steam for domestic hot water, steam driven laundry presses, air conditioning system reheat, food preparation and dishwashing demands of twenty-two buildings on the base.

This project is conducted in support of the National Energy Conservation Policy Act (NECPA). ESOS projects have the prime objective of evaluating energy conservation opportunities (ECOs) in quest of meeting the goals of the NECPA, the Army Energy Plan, and the Department of Defense Energy Management Plan.

This study constitutes a final submittal and includes the project criteria and the methodology used for conducting this analysis. The study also includes an Energy Conservation Investment Program (ECIP) analysis summary for each alternative or ECO that was evaluated.

Engineering services for this project are being provided by Engineering Applications Consultants, P.C. under contract number DACA 31-89-C-0198 for the Department of the Army, Baltimore District Corps of Engineers.

Significant assistance and cooperation for this analysis has been provided by the Corps of Engineers and the operations personnel at Fort Myer. EAC wishes to extend special appreciation to Mr. James Hawk, Mr. Ralph Gibson, and Mr. Richard Rice for their cooperation and guidance which has contributed to the development of this study.

2. PROJECT SUMMARY AND RECOMMENDATIONS

This study contains the findings of the Summer Steam Shut Down Study at Fort Myer, Virginia, and is based on field survey, discussions with the users and the operating personnel, and the review of drawings and other documents whenever available. Volumes I and II of this study contain the executive summary, project criteria, study methodology, building narratives, and the results of the analysis. Volume III contains calculations and supporting data for the study. Volume IV is a compilation of the data and notes generated from field investigations.

The project criteria lists environmental conditions within the buildings and climatic data applicable to the project site. Also included under project criteria are the fuel rates, economic life of the improvements, and discount factors used in this analysis.

The methodology section of this study contains a description of energy conservation opportunities (alternatives) considered, and the procedures for calculating the energy savings. The nature of the alternatives outlined in the scope of work provides for no interaction or "overlapping" of energy saving measures, and thus no synergistic effects exist between ECO's.

This analysis investigates the economic feasibility of providing the buildings listed with an alternate source of steam during the non-heating months. The buildings considered for evaluation of summer steam requirements are 246, 247, 248, 249, 250, 251, 400, 402, 403, 404, 405, 406, 407, 410, 411, 416, 423, 450, 452, 469, 501, and 525. Of these 22 buildings covered under this study, 11 were selected to be surveyed to establish baseline criteria for each type of building. From the baseline criteria, prorated results could then be estimated for the remaining buildings. The buildings surveyed were 246, 249, 400, 402, 404, 407, 411, 423, 450, 501, and 525. Due to unique variations within some of the buildings not surveyed, additional field investigations were performed to verify and improve the "models" used to represent them.

The following alternatives for independent steam and hot water generation have been considered:

Alternative 1 — Provide one gas-fired individual boiler in each of the 22 buildings.

Alternative 2 — Provide one central gas-fired boiler to serve Enlisted Barracks buildings 246, 247, 248, 250, and 251; and provide one gas-fired individual boiler in each of the 17 other buildings. Due to the requirements of the Enlisted Barracks "central" boiler, a remote structure will be required, and thus only one location has been analyzed.

Alternative 3 — Provide electric boilers in lieu of gas-fired boilers where applicable.

Alternative 4 — a. Provide condensing type gas-fired boilers (or high efficiency type) in lieu of standard gas-fired boilers, as applicable, in Alternative 1.

b. Provide condensing type gas-fired boilers (or high efficiency type) in lieu of standard gas-fired boilers, as applicable, in Alternative 2.

The results of this analysis are that all of the alternatives examined meet the qualifications for the ECIP criteria (refer to section Energy Plan below).

Table 1. ECIP Analysis Results

Alt.	Total Investment	Annual Energy Savings (MBTU) Elec.	Oil	Gas	Total	Annual Savings ($) Energy	Non-Energy	SIR	Simple Payback
1	$ 954,240	249	14,909	23,641	38,799	119,468	341,567	7.45	2.07 yrs
2	$ 956,480	206	14,909	23,830	38,946	120,163	341,567	7.45	2.07 yrs
3	$1,002,400	-537	14,909	24,627	38,999	102,160	340,630	6.86	2.26 yrs
4a	$1,013,600	251	14,909	23,797	38,957	120,502	341,567	7.03	2.19 yrs
4b	$1,015,840	208	14,909	23,987	39,104	121,209	341,567	7.04	2.20 yrs

Though various alternatives provide slightly different approaches to meeting summer period steam demands, there are two key factors common to all alternatives that dictated the close results, leaving only small differences between the alternatives. Energy savings range from 38,799 MBTU in Alternative 1 to 38,957 MBTU in Alternative 4, and total monetary savings range from $442,790 in Alternative 3 to $462,776 in Alternative 4.

One reason for the similar results among the alternatives is that for many of the buildings studied, the steam demand was large enough and did not allow the use of higher efficiency equipment. Thus a major portion of each alternative consists of the same large gas-fired boilers. As seen with Alternatives 3, 4a and 4b, when the use of the electric or high-efficiency gas equipment is extended to some of the buildings which are borderline cases, the increased investment costs are not recovered through improved fuel economy. Moreover, the total natural gas consumption in Alternatives 3, 4a and 4b does not decrease more than 6.3% from the gas consumed in the baseline option, Alternative 1.

In Alternative 3, there is an additional penalty with the cost of electricity being nearly 3.5 times the cost of natural gas, not including the extra demand charge. It is this demand charge, however, that significantly limits the use of electric powered equipment. In the summer, it is certain that any increase in load will result in an increase in the peak load because the air conditioning chillers will also be in use. This higher peak load will then be used to determine the demand charge for the

month. In the Army Corps of Engineers Technical Manual 5-810-5, paragraph 4-4.c.2 acknowledges this cost of electricity and states that "because of the high operating cost of electrical equipment, electricity is not used for large-volume water heating when natural gas is available." This study has used electric equipment to satisfy only the smaller hot water demands among the buildings to analyze Alternative 3. Extending the use of electric equipment to buildings with larger demands yields even less desirable results.

The second, and perhaps most significant reason for the small variance in the results, is that a considerable portion of the savings in each of the alternatives resulted from a reduction in the operations and maintenance costs associated with the Central Boiler Plant, Building 447. The costs used to determine these savings were based on fiscal year 1991, and amount to approximately 80% of the $461,035 of anticipated (first year) total annual savings. It should be recognized that the change over from fuel oil to natural gas took place in October 1990, and that part of the year may have non-routine service and maintenance costs included. While the calculations have included central plant operations costs as an item of savings, maintenance and repair costs of the central boiler plant and the extensive distribution system, including any of the "non-routine" services, are not considered as savings under any of the proposed alternatives. The maintenance and repair work will still be required on an annual basis in order to provide an operational central heating system for the following winter.

The direct energy savings shown in Table 1 for each alternative are the combined results of three factors. First, all of the alternatives benefit from a direct energy savings of over 50% at the points-of-use in the buildings. As verified during the field investigations, most of the higher energy using buildings have, within the past 15 years, switched to instantaneous type domestic water heating equipment and have been provided with little or no hot water storage capacity. This approach to satisfying a hot water demand does not consider that a duration of peak use will be followed by an extended period of low use, and consequently, an opportunity for balanced recovery. Thus, instantaneous equipment allows for a peak condition to be satisfied indefinitely and does not encourage users to be energy efficient. Current Army Technical manual 5-810-5 provides for sizing

equipment using storage capacity and takes durations of peak use into consideration. This practice leads to equipment of significantly smaller capacities and will not allow for misuse of hot water.

The second factor leading to direct energy savings is that most of the buildings are using hot water at 120°F to 140°F. Presently, Army regulations provide for a temperature of 95°F at the point of use for general domestic washing applications. The calculations for this study use storage tank temperatures of 100°F to 110°F. Applications that require elevated temperatures, such as dishwashing, use local temperature boosting equipment which is generally steam fired.

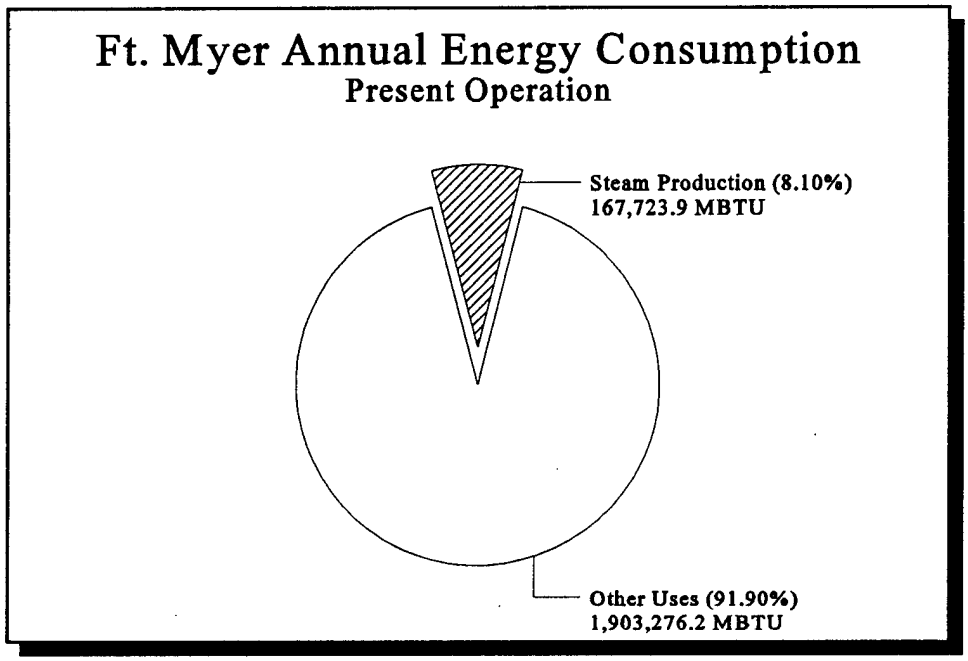
The third factor is the difference in the cost of natural gas for standard and interruptible services. The central boiler plant qualifies for the lower interruptible rate (approximately 60% of the normal service rate) because the equipment can be fired with fuel oil as well, according to the utility company Washington Gas, regardless of any on-site oil reserves. It is an assumption of this study that the local boilers and water heaters would not be provided with the capability of burning fuel oil and thus will not be able to benefit from the much lower interruptible service gas rate. Though environmental regulations may, in the future, provide clean burning gas suppliers an arm to leverage higher interruptible service rates to users who could burn heavier fuel oils, Washington Gas is not forecasting this increase. This study assumes only standard trends, as stipulated in the recent ECIP criteria, will affect fuel prices. The remaining price difference between the services is accounted for by using an adjusted or "penalized" rate in calculating the cost savings resulting from lower natural gas usage of the various alternatives.

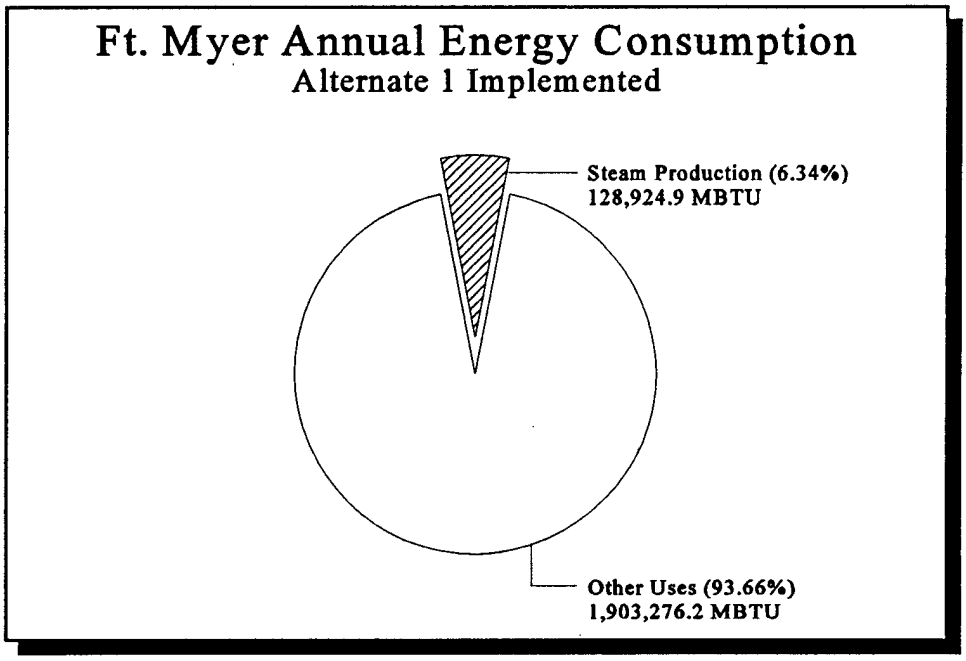
A final consideration in analyzing the energy savings is that the central steam distribution system is aging as indicated by leaks, malfunctioning valves, and deteriorating insulation and bare pipes. Using local steam equipment avoids these energy losses, and also provides a period to address maintenance needs on a scheduled basis to prepare the system for use during the winter months. The steam distribution systems within the buildings surveyed appears to be in good condition and do not contribute significantly to the loss of steam from the central system. However, the steam presses in the barracks buildings would remain as a point-of-use steam loss for all of the alternatives considered.

This analysis has shown that Alternatives 1 and 2 are the most favorable in meeting the ECIP criteria and would have economic benefits if implemented. Because there is little or no economic difference between Alternatives 1 and 2, Alternative 1 is recommended as a more flexible and more aesthetically pleasing alternative. In Alternative 2, the semi-central boiler system serving the "Old Guard" barracks was analyzed with the provision of two boilers to be operated in a back-up or redundant fashion. If the barracks were to depend on one boiler for their entire needs, there would be a greater chance of a breakdown affecting all of these barracks than with an independent boiler for each building as provided in Alternative 1. Therefore, to yield an accurate comparison, only viable installations could be considered. In addition, Alternative 2 provides for a separate structure which would be located behind the "Old Guard" buildings. This could detract from the appearance of the installation from the outside (Arlington Boulevard exposure), and would limit any future use of this space. The areas under consideration are presently used for parking, access to the buildings, and various training exercises by the "Old Guard" companies.

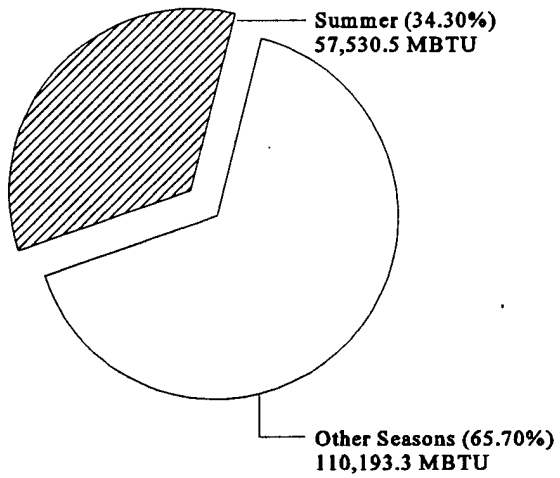
3. ENERGY CONSUMPTIONS AND SAVINGS

The following figures present the estimated basewide energy usage patterns before and after the implementation of Alternative 1; providing an individual gas fired boiler or domestic water heater, as applicable, in each building currently served by the central steam plant during the summer period.

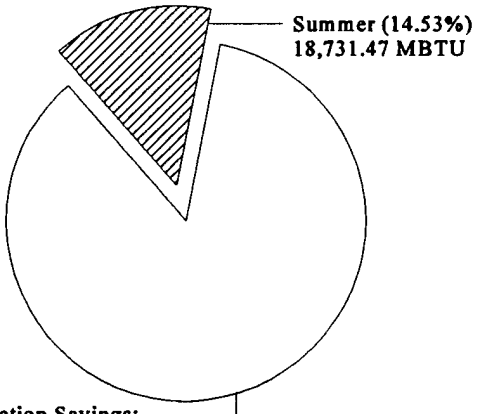




Seasonal Steam Production Energy Usage
Present Operation



Seasonal Steam Production Energy Usage
Alternate 1 Implemented



Annual Steam Production Savings:
$461,035 (21.7%) *
*** Includes Operations Costs**

4. ENERGY PLAN

The Energy Conservation Investment Program (ECIP) is available for the energy conservation opportunity (ECO) analyzed in this report. ECIP funding can apply to projects which have a construction cost estimate greater than $300,000, a savings to investment ratio (SIR) greater than 1.25 and a simple payback period of ten years or less. ECIP projects are also assessed a level of risk associated with continuity of the base mission and stability of the baseline energy consumption used in the analysis calculations.

The services provided by Fort Myer are expected to be required throughout the foreseeable long term. Accordingly, it is also expected that the energy baseline used in the preparation of this analysis will remain stable for the period of the savings calculation.

ENERGY SAVINGS OPPORTUNITY SURVEY
FORT MYER, ARLINGTON, VIRGINIA

SUMMER STEAM SHUT-DOWN STUDY

A/E CONTRACT NO.
DACA 31-89-C-0198

VOLUME II

Engineering Study

Prepared for

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT CORPS OF ENGINEERS
BALTIMORE, MARYLAND

By

ENGINEERING APPLICATIONS CONSULTANTS, P.C.
9004-B CROWNWOOD COURT
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March 1994

5. PROJECT CRITERIA

The analyses of the building energy usage and the estimated reduction in the energy usage due to the implementation of the proposed energy conservation opportunities are based on the criteria set forth here.

5.1 Outdoor Conditions

Based on publication TM 5-785 "Engineering Weather Data", the following outdoor condition has been assumed:

Summer 91°F DB, 74°F WB

5.2 Indoor Conditions

The indoor conditions have been selected, following the guidelines of TM 5-810-1 "Mechanical Design; Heating, Ventilating and Air-Conditioning" and MIL-HDBK-1191 "Medical and Dental Treatment Facilities, Design and Construction Criteria", based on primary activity within a building. The following indoor condition has been assumed:

Summer 78° F, 50% relative humidity

Any deviations from the assumed indoor temperature for specific areas are noted in the building narrative. The hours of operation and occupancy levels are based on information obtained from the Post and data collected during field visits to various buildings.

5.3 Steam and Domestic Hot Water Equipment

The capacities of all new steam and domestic hot water generating equipment analyzed in this study are calculated in accordance with TM 5-810-5, Chapter 4 "Water Supply and Distribution". In addition, values for domestic hot water use temperatures are selected in accordance with Army Regulation 11-27 "Army Energy Program". Conditions used for determining the equipment capacities are as follows:

Domestic Hot Water (point of use) -	95°F
Medical and Family Housing buildings -	110°F
Entering Cold Water Temperature -	40°F
Storage Water Temperatures -	100°F to 110°F
Usable Volume in Storage Tanks -	75%

Applications that require elevated temperatures, such as dishwashing, are exempt from AR 11-27 and use local temperature boosting equipment which is generally steam fired. Estimates for the operation and maintenance requirements of the steam and hot water equipment follow the guidelines established in Army Regulation 420-49.

5.4 Fuel Rates

Fuel rates used for the analysis were obtained from the Fort Myer Engineering Activity division and are listed below. The central boiler plant, Building 447, currently uses natural gas to generate steam. However, until October 31, 1990 steam was produced by burning fuel oils #2, #5, or #6. In order to benefit from an interruptible gas service rate, the fuel oil systems at Building 447 are still in place and are used during periods of curtailed gas supply. Complete fuel rates and boiler plant operating logs as provided by Fort Myer are included in Appendix B.

5.4.1 Electricity

Virginia Power's Schedule MS for Federal Government installations has been used, with the additional input of -$0.0067/KWH as fuel adjustment factor (effective since March, 1992). This schedule is included in Appendix B.

5.4.2 Natural Gas

Natural Gas is supplied throughout Fort Myer by Washington Gas. The distribution lines on the base are owned and maintained by Washington Gas, and each building that receives service is metered separately. The natural gas rate used in the calculations is a projected average cost of $0.62 per therm. The following list shows the annual average costs for gas service for the past two years. The future cost is expected to be slightly higher than the current rate.

Fiscal Year	Average Rate
1991	$0.68 per therm
1992	$0.62 per therm

The boiler plant (Building 447), however, qualifies for a lower interruptible natural gas service rate. The gas rate used in the calculations for steam generation at Building 447 is based on a projected average cost of $0.38 per therm. The following list shows the annual average cost for gas service to Building 447 for the past two years. The future cost is expected to be slightly higher than the current rate. Though environmental regulations may, in the future, provide clean burning gas suppliers an arm to leverage higher interruptible service rates to users who could burn heavier fuel oils, Washington Gas is not forecasting this increase. This study assumes only standard trends, as stipulated in the recent ECIP criteria, will affect fuel prices.

Fiscal Year	Average Rate
1991	$0.43 per therm
1992	$0.35 per therm

5.4.3 Fuel Oil

Presently, fuel oil is used at the central boiler plant only when natural gas service is interrupted. The fuel oil rate used in the calculations for steam generation at Building 447 is a projected cost of $0.69 per gallon. Fuel oil costs have been as follows:

Fiscal Year	Fuel	Rate
1990	#2 or #5 Oil	$0.54 per gallon
1990	#6 Oil	$0.52 per gallon
1991	#2 or #5 Oil	$1.03 per gallon
1991	#6 Oil	$0.99 per gallon
1992	#6 Oil	$0.69 per gallon

5.4.4 Steam Generation

For fiscal year 1991, 77% of the total steam generated was produced using natural gas and 23% using #6 fuel oil. Including all fuel, maintenance, operations, and distribution costs, the average total cost for steam production in fiscal year 1991 was $13.80 per 1000 pounds of steam generated.

5.5 Economic Analysis

Energy Conservation Investment Program (ECIP) Guidance Memorandum CEHSC-FU-M, November 1992, and TM 5-802-1 "Economic Studies for Military Construction Design -- Applications", December 1986, are used as the basis of this study. It should be noted that a recent revision to the ECIP criteria, dated January 1994, requires that qualifying projects shall have Savings to Investment Ratios (SIRs) greater than or equal to 1.25. This additional information was provided by a telephone conversation with Mr. Henry Gignilliat of the Army Center for Public Works on September 2, 1993, as documented in Appendix C of this report.

As stipulated in the ECIP guidelines, economic lives have been based on the lesser of 25 years or the useful life of an ECO. The remaining lives of the buildings are assumed to exceed 25 years. Boiler plant modifications are based on an economic life of 20 years. With this energy conservation measure, there are no replacement costs to be considered as the life of all installed equipment, piping, and architectural features is 20 years or greater. There are also no equipment salvage costs or savings to consider as all proposed equipment will be brought into service, while all existing equipment will remain in service for use, as a minimum, during the winter period. Maintenance costs are a significant factor in this analysis and are presented in detail in Volume III: Engineering Calculations.

The Uniform Present Worth (UPW) factors published for Region 3 by the Department of Energy (DOE) under the Federal Energy Management Program (FEMP), November 1992 issue have been used in accordance with the guidance for the Energy Engineering Analysis Program (EEAP). A discount rate of 4% has been used in conformance with the ECIP guidelines.

6. METHODOLOGY

6.1 Data Collection and Correlation

A great deal of emphasis was placed upon gathering data for the summer period steam-energy consuming systems of the buildings and their operating characteristics.

6.1.1 Drawings and Other Documents

An earnest effort was made to locate drawings, specifications, shop drawings, cut-sheets and any other documents which could provide information regarding the existing equipment, buildings' operating characteristics and operating procedures. Further, data for operating hours and occupancies was obtained through discussions with building managers and personnel most familiar with each building. Maintenance and operating personnel were interviewed to arrive at a realistic understanding of the domestic hot water and HVAC systems within the buildings.

6.1.2 Field Surveys

Engineering teams were organized to conduct field surveys. The team members were well prepared for this work by in-office study of drawings and other documents. Suitable forms for field data were prepared to make sure that comprehensive data was collected efficiently and that there was no unnecessary interruption of the occupants' work. The surveys covered domestic hot water heating and distribution systems, the number and types of plumbing fixtures using hot water, building operation, occupancies; and as dictated by summer steam use in HVAC (heating, ventilating, and air conditioning) systems, building envelopes and energy-consuming items like computers, appliances, lighting and mechanical systems. Whenever possible, the

survey teams took the opportunity to discuss with the occupants the working characteristics of their respective areas.

This information was collated and checked for any deficiencies or discrepancies and was corrected either by checking drawings, by further discussions with the operating personnel and by additional field visits.

6.2 Computer Simulation

The calculation of energy consumption, where required, was obtained by computer simulation using E20-II. E20-II, Hourly Analysis Program (HAP) has been developed by Carrier Corporation. As its name implies, the program performs hourly calculations based on weather data. As with any such program, to obtain a reasonably accurate simulation, certain assumptions were made to adapt the field data for program input. Some of the assumptions were general, while others were specific to each building.

Computer simulation was required for Building 400 "Band" and Building 525 "Rader Clinic".

General Assumptions

The following general assumptions were made for all buildings where computer simulation was used:

- U-values for the walls and roof systems were either calculated from data collected in the field, or from information on the drawings.

- Holidays were considered to have the same characteristic loads as Sundays.

- Schedules for various loads like lighting, people, and heat producing equipment were based on field observations, interviews with operating personnel and common practice in the industry.

- Plant data has been obtained from field observations and manufacturer's catalogs.

- Ventilation data, supply air temperatures and other data have been obtained from drawings.

- The infiltration rate has been calculated based on the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) "Fundamentals Volume, Chapter 23", 1993.

Due to the large amount of specific assumptions used in the computer simulations, discussion of all of the variables becomes too cumbersome to be presented in this text. Please refer to Volume III "Engineering Calculations" for the discussion of specific input variables and the output analyses.

6.3 Summer Steam Use Evaluation

Certain buildings at Fort Myer require summer steam for domestic hot water generation, air conditioning reheat, operation of laundry presses, and food preparation equipment.

The objective of this evaluation is to investigate the economic feasibility of providing the buildings listed with an alternate source of steam during the non-heating months. The buildings listed for evaluation of summer steam requirements are 246, 247, 248, 249, 250, 251, 400, 402, 403, 404, 405, 406, 407, 410, 411, 416, 423, 450, 452, 469, 501, and 525. Of these 22 buildings covered under this study, 11 were selected to be surveyed to establish baseline criteria for each type of building. From the baseline criteria, prorated results could

then be estimated for the remaining buildings. The buildings surveyed were 246, 249, 400, 402, 404, 407, 411, 423, 450, 501, and 525. Due to unique variations within some of the other buildings, additional field investigations were performed in buildings 247, 248, 250, 251, 403, 405, 410, 416, 452, and 469 to verify and improve the "models" used to represent them.

The collected information was compiled, and then used to calculate steam and hot water demands, select equipment, determine initial investment costs, and to determine summer energy consumption by domestic hot water generators, air conditioning reheat systems, and other steam consuming systems in each of the buildings. Cost data for initial investment calculations were taken from Construction and Mechanical Cost Data by the R.S. Means Company.

Additional information was collected regarding the central heating plant at Building 447. Facilities engineering operating logs and Base Utilities records were obtained indicating actual steam produced and fuel oil, natural gas, and makeup water expended on a daily basis. This, in turn, provides the actual plant efficiency.

The following alternatives have been considered:

Alternative 1: Provide one gas-fired individual boiler in each of the 22 buildings.

Alternative 2: Provide one central gas-fired boiler to serve Enlisted Barracks buildings 246, 247, 248, 250, 251, and 410; and provide one gas-fired individual boiler in each of the 16 other buildings. Due to the size to the Enlisted Barracks "central" boiler, a remote structure will be required, and thus only one location has been analyzed.

Alternative 3: Provide electric boilers in lieu of gas-fired boilers where applicable.

Alternative 4:

a. Provide condensing type gas-fired boilers (or high efficiency type) in lieu of standard gas-fired boilers, as applicable, in Alternative 1.

b. Provide condensing type gas-fired boilers (or high efficiency type) in lieu of standard gas-fired boilers, as applicable, in Alternative 2.

Discussions with base facilities personnel indicated that although summer-winter system changeover is on a building by building basis, generally this occurred about May 15th and October 15th. This five month period defines the summer period of operation.

The savings associated with around-the-clock expenses of operating personnel, fuel, electricity, etc., were compared with the initial investment, energy usage, maintenance, and custodial costs of each alternative to determine qualification with ECIP guidelines.

7. BUILDING NARRATIVES

7.1 Building 246 - Enlisted Barracks

General: Building 246, constructed around 1895, is a three story, "U-shaped" structure with above grade walls built of stone with red face brick and interior finishes of painted plaster with some wood paneling. The building also has a basement level with a concrete foundation approximately 9 feet below grade. The basement walls are constructed of stone with a rough plaster or heavily painted interior finish. The roof is a gabled wood frame structure with slate shingles. The building space consists of the basement which houses mechanical equipment and steam presses for uniforms, two full stories of typical barracks, and a finished attic level having lockers and storage space for company personnel located off-post. The building has a gross area of approximately 73,000 square feet.

Domestic Hot Water: The building receives high pressure steam of approximately 110 psig from the central plant at Building 447. The steam is then reduced to a lower pressure of approximately 10 psig to serve two identical, semi-instantaneous type domestic hot water generators. One generator is located in the basement of the North wing, and the other is located in the basement of the South wing. Each generator consists of a steam-fired instantaneous heater coupled with a 62 gallon storage tank, and is rated as using 3,900 lbs/hr of steam to provide 78 gpm of hot water at a temperature increase from 40°F to 140°F. Presently, each generator provides hot water at a temperature of approximately 135°F. The hot water from each generator is supplied initially through a 2" pipe, which is then reduced to a 1½" pipe for distribution to the building. Each generator also has a 2" recirculating hot water line that returns from the building and connects to the 62 gallon storage tank.

The domestic hot water load of the building is comprised of the following:

Showers -	25
Lavatories -	23

Clothes Washers - 6

Service Sinks - 2

There are a combined total of 224 "on-post" and "off-post" personnel that can possibly use the showers in a day. Although the showers are used in two sessions, 6:00am-9:00am and 5:00pm-8:00pm, each person takes only one shower per day.

Steam Presses: There are four steam driven presses, all located in the basement of the North wing. Three of the presses are identical and are used for typical uniform work. The fourth press has specialty surfaces for use with odd shaped work. All four presses are manufactured by Forenta of Morristown, Tennessee. The presses require a steam supply of 80 psig, and are currently operating with 80-90 psig steam supplied through a ¾" control valve.

The presses can be in operation for up to 22 hours per day over a two week period each month. According to the manufacturer, the typical uniform press requires 1.00 boiler horsepower or 33,472 Btu/hr, during continuous, normal and safe operation. When busy, the operation of the uniform presses from one user to the next is almost continuous, and can be maintained for over one hour at a time. The specialty press requires 0.25 boiler horsepower or 8,368 Btu/hr during continuous normal operation. The specialty press, however, is used much less frequently than the uniform presses and is not in continuous operation from one user to the next.

Air Conditioning: The building has two shell and tube steam to hot water converters for building hydronic heating purposes. None of the air conditioning systems uses energy for reheat or humidity control purposes.

7.2 Building 247 - Enlisted Barracks

General: Building 247 is similar to Building 246. One minor difference to note is that 20 rooms on the first floor have been converted to office space, and consequently there are only 58 personnel that use the showers and uniform presses. The building is the same size as Building 246 and has a gross area of approximately 73,000 square feet.

Domestic Hot Water: The building receives high pressure steam at approximately 110 psig. The steam is then reduced to a lower pressure of approximately 11 psig to serve a single hot water generator that consists of a shell-and-tube heat exchanger with an 80 gallon storage tank. The system is estimated to provide 40 gallons per minute of 135°F hot water using 2,090 pounds of steam per hour.

Steam Presses: There are three typical uniform presses, as described under Building 246, located in the basement. The use is considered to be the same as that in Building 246, and are currently operating with 80-90 psig steam.

Air Conditioning: The building has shell and tube steam to hot water converters for building hydronic heating purposes. None of the air conditioning systems uses steam for reheat or humidity control purposes.

7.3 Building 248 - Enlisted Barracks

General: Building 248 is virtually identical to Building 246 in construction with a gross square footage of approximately 69,600 square feet. A portion of the building is office space, and consequently there are only 85 personnel that use the showers and uniform presses. The building, however, is divided between two companies and thus personnel in one company do not have access to all facilities of the other company.

Domestic Hot Water: The building receives high pressure steam at approximately 110 psig. The steam is then reduced to a lower pressure of approximately 11 psig to serve a single instantaneous shell-and-tube heat exchanger hot water generator. The system is estimated to provide 80 gallons per minute of 135°F hot water using 4,179 pounds of steam per hour.

Steam Presses: The presses are identical to those described under Building 246, however there are six of the typical uniform type and one of the specialty type. The use is considered to be the same as that in Building 246, and they are currently operating with 80-90 psig steam.

Air Conditioning: None of the air conditioning systems uses steam for reheat or humidity control purposes.

7.4 Building 249 - Enlisted Barracks

General: Building 249 is of the same construction as Building 246, but has a gross square footage of approximately 32,000 square feet. Though the building is a three story, U-shaped structure with a basement, the wings are significantly shorter in length which gives Building 249 about half the gross square footage of Buildings 246, 247, and 248. Also, the first floor of the building is designated as the "Old Guard Museum" and is not part of the barracks space. The upper levels are used for bunks and storage. There are approximately 37 personnel that use the facilities in the building.

Domestic Hot Water: The building receives high pressure steam at approximately 110 psig. The steam is then reduced to an assumed lower pressure of approximately 8 to 10 psig to serve a single tank type hot water generator with an internal heat exchanger. The system is estimated to provide 3.67 gallons per minute of 140°F hot water using 192 pounds of steam per hour.

Steam Presses: There are no presses in this barracks building.

Air Conditioning: None of the air conditioning systems uses steam for reheat or humidity control purposes.

7.5 Building 250 - Enlisted Barracks

General: Building 250 is virtually identical to Building 249 in construction with a gross square footage of approximately 29,600 square feet. The building space consists of the basement which houses mechanical equipment and steam presses for uniforms, two stories of typical barracks, and a finished attic level having lockers and storage space for company personnel located off-post. There are 83 personnel that use the showers and uniform presses.

Domestic Hot Water: The building receives high pressure steam at approximately 110 psig. The steam is then reduced to a lower pressure of approximately 8 psig to serve a single hot water generator that consists of a shell-and-tube heat exchanger with an 66 gallon storage tank. The system is estimated to provide 45 gallons per minute of 140°F hot water using 2,351 pounds of steam per hour.

Steam Presses: There are two typical uniform presses, as described under Building 246, located in the basement. The use is considered to be the same as that in Building 246, and are currently operating with 80-90 psig steam.

Air Conditioning: None of the air conditioning systems use steam for reheat or humidity control purposes.

7.6 Building 251 - Enlisted Barracks

General: Building 251 is similar to Building 249 in construction with a gross square footage of approximately 38,400 square feet. The building space consists of the basement which houses mechanical equipment and steam presses for uniforms, two stories of typical barracks, and a finished attic level having lockers and storage space for company personnel located off-post. There are 120 personnel that use the showers and uniform presses.

Domestic Hot Water: The building receives high pressure steam at approximately 110 psig. The steam is then reduced to a lower pressure of approximately 8 psig to serve a single hot water generator that consists of a shell-and-tube heat exchanger with a storage tank. The system is estimated to provide 14.5 gallons per minute of 140°F hot water using 755 pounds of steam per hour.

Steam Presses: There are three typical uniform presses, as described under Building 246, located in the basement. The use is considered to be the same as that in Building 246, and they are currently operating with 80-90 psig steam.

Air Conditioning: None of the air conditioning systems uses steam for reheat or humidity control purposes.

7.7 Building 400 - Band

General: Building 400, constructed in 1975, is a steel and cinder block structure with red face brick exterior finish. The interior finishes vary from painted cinder block and drywall to complex acoustical treatments of wood grating, fiberglass insulation and cloth in the Major and Minor Music Studios. The Studios are essentially auditoriums with the larger Major Studio holding approximately 475 people during performances. The roof is a built up type with various slopes that correspond to the dimensions of the inner spaces. The building

space also consists of a single story administrative office wing, music practice rooms, locker/shower rooms, a music library, large storage spaces and a centrally located upper level mechanical room which houses the air handling and domestic hot water equipment. The building slab is concrete and varies in buried depth from zero to three feet below grade. The building has a gross area of approximately 31,500 square feet.

Domestic Hot Water: The building receives high pressure steam of approximately 110 psig from the central plant at Building 447. The steam is then reduced to a lower pressure of approximately 8 psig to serve a single tank type hot water generator with an internal heat exchanger. The system was designed to provide 6 gallons per minute of 140°F hot water (with an entering water temperature of 40°F) using 315 pounds of steam per hour. The hot water is supplied from the generator through a 1" pipe. The generator also has a 3/4" recirculating hot water line that returns from the building. The building is occupied from 7:00am-4:00pm on weekdays, and occasionally there is an evening performance held on a weekday or weekend night.

Steam Presses: There is one uniform press in the building, however it is electric powered and does not constitute a summer steam load.

Air Conditioning: The building has one shell and tube steam to hot water converter for building hydronic heating and hydronic reheat purposes. There are two reheat systems in the building that can use steam during the summer period. The Administrative area is served by a variable volume air system with terminal reheat, and the Major Studio air handling unit has been modified to provide humidity control through the constant volume system.

Through a complete analysis and computer simulation of the Administrative area system, it was found that reheat does not activate during the summer period. There is steam in the heating months from November to March, due to the cooler outside temperatures, but during the summer, none of the spaces are over-cooled at the minimum supply air condition and demand reheat to maintain the space temperature.

Through simulation of the Major Studio, it was found reheating of dehumidified air was required to maintain the space conditions during the summer months. The calculated reheat energy demand for this period is 1,622.67 MBTU (million British Thermal Units).

7.8 Building 402 - Enlisted Barracks

General: Building 402, constructed in 1965, is a four story, "H-shaped" structure with walls built of cinder block with light red face brick on exposed surfaces, and interior finishes of painted plaster. The building also has a basement level with a concrete foundation generally 9 feet below grade. The basement walls are constructed of painted cinder block. The roof is a flat, built-up type. The building space consists of the basement which houses mechanical equipment, four full stories of typical barracks with center common areas. The building has a gross area of approximately 109,800 square feet.

Domestic Hot Water: The building receives high pressure steam at approximately 105 psig from the central plant at Building 447. The steam is then reduced to a lower pressure of approximately 20 psig to serve a semi-instantaneous type domestic hot water generator. The generator consists of a steam-fired instantaneous heater coupled with a 150 gallon storage tank, and is estimated as using 4,255 lbs/hr of steam to provide 80 gpm of hot water at a temperature increase from 40°F to 140°F. The hot water from the generator is supplied through a 2" pipe for distribution to the building. The generator also has a 1½" recirculating hot water line that returns from the building and connects to the storage tank.

The domestic hot water load of the building is comprised of the following:

Showers -	64
Tubs -	24
Lavatories -	133
Clothes Washers -	48

Service Sinks - 25

Kitchen Sinks - 4

There are a combined total of up to 250 "on-post" and "off-post" personnel that can possibly use the showers in a day. Although the showers are used in two sessions, 5:30am-6:30am and 5:00pm-6:00pm, each person takes only one shower per day.

Steam Presses: There are no presses in this barracks building.

Air Conditioning: The building has two shell and tube steam to hot water converters for building hydronic heating purposes. None of the air conditioning systems uses steam for reheat or humidity control purposes. The multizone air handling unit located in the basement operates on a changeover type of system whereby both decks operate in the heating mode during the winter and in the cooling mode during the summer.

7.9 Building 403 - Enlisted Barracks

General: Building 403 is basically of the same design and construction as Building 402, however Building 403 is approximately 50% larger. Building 403 has a gross area of approximately 169,100 square feet. Different from Building 402, however, are an evening use cafe or snack bar and a daily use exercise and weight lifting room, both located in the southwest part of the building on the ground floor.

Domestic Hot Water: The domestic water heating system is assumed to be proportionally larger than the original storage type system of Building 402, and is estimated as using 5,266 lbs/hr of steam to provide 99 gpm of hot water at a temperature increase from 40°F to 140°F. The weight lifting area has 6 showers, a clothes washer and a sauna; however all hot water demands are met by a single 118 gallon electric water heater with dual 13.5 kW elements. The cafe uses plastic cups for beverages and styrofoam plates for food and thus

does not have a dishwashing hot water demand. There is a service sink in the cafe. There are a combined total of 525 "on-post" and "off-post" personnel that can possibly use the showers in a day.

Air Conditioning: Using Building 402 as a model, it can be assumed that none of the air conditioning systems uses steam for reheat or humidity control purposes.

7.10 Building 404 - Dining Facility

General: Building 404, constructed in 1964-65, is a single story, square footprint structure with walls built of cinder block with light red face brick on exposed surfaces. The roof is a flat, built-up type. The building space consists of two large dining rooms, the kitchen, two separated dishwashing rooms, the main mechanical room, and a remote air handler room. The building has a gross area of approximately 32,500 square feet.

Domestic Hot Water: The building receives high pressure steam of approximately 105 psig from the central plant at Building 447. The steam is then reduced to a lower pressure of approximately 10 psig to serve a semi-instantaneous type domestic hot water generator. The generator consists of a steam-fired instantaneous heater coupled with a 90 gallon storage tank, and is rated as using 7,895 lbs/hr of steam to provide 100 gpm of hot water at a temperature increase from 40°F to 190°F, however is currently supplying water at 158°F. The hot water from the generator is distributed to the building through a 2" pipe.

The dining facility serves three meals every day:

Breakfast	5:30am-8:30am weekdays
	7:00am-9:00am weekends
Lunch	11:00am-2:00pm everyday
Dinner	4:00pm-7:00pm weekdays
	4:30pm-6:30pm weekends

Approximately 400-500 meals are served during each three-hour period.

Air Conditioning: The building has a shell and tube steam to hot water converter for building hydronic heating purposes. Though there are duct mounted hot water coils in the perimeter air systems which are called "reheat coils" on the construction documents, further investigation and interview with operations personnel revealed that these coils provide perimeter heat in the non-cooling months only. None of the air conditioning systems uses steam for reheat or humidity control purposes.

Other Steam Uses: The facility also uses steam for cooking and dishwashing purposes. In the kitchen, jacketed kettles use steam by circulating the flow between an inner and outer shell of the kettle. Heat from the steam is transferred to the food in the kettle, and because the steam is not exposed to the food or the atmosphere, the condensate is returned to the central system. Similarly, on the food serving lines, several of the "warm" tables use steam in the same fashion to maintain food temperature. Condensate from the tables is also returned to the central system. Steam is used in dishwashing to boost the temperature of the incoming domestic hot water to a sanitizing level of 190°F or 200°F. Again, heat transfer is accomplished through heat exchangers that do not permit contact of the steam with the heated medium, and the condensate is returned to the system. The point-of-use loss of steam from the central system at Building 404 is essentially zero. Typically, steam loss occurs at exterior leaks, laundry steam presses, and safety valve discharges; and not at the cooking or dishwashing equipment.

The combined peak energy demand of these operations is 2178.2 kBTU/hr (thousand British Thermal Units per hour), and the estimated total summer usage is 2,515.82 MBTU (million British Thermal Units).

7.11 Building 405 - Recreation Center

General: Building 405, constructed in 1968, is a single story, rectangular footprint structure with walls built of cinder block with light red face brick on exposed surfaces. The roof is a flat, built-up type. The building has a gross area of approximately 15,700 square feet. The general function of Building 405 is for recreation with a main auditorium that can seat 450 people, and other spaces for billiards, music practicing, watching TV. Building 405 does not have cooking facilities, however there is discussion of a kitchen renovation and the possible addition of a dishwasher.

Domestic Hot Water: Building 405 meets its present demand with a vertical type, steam fired hot water generator with a 220 gallon storage tank holding water at a temperature of 140°F. The hot water from the generator is supplied through a 1½" pipe for distribution to the building.

Steam Presses: There are no presses in this building.

Air Conditioning: It is assumed that none of the air conditioning systems uses steam for reheat or humidity control purposes.

7.12 Building 406 - Enlisted Barracks

General: Building 406, is identical to Building 403. The narrative for Building 403 applies with the exception of the cafe and the weightlifting room.

7.13 Building 407 - NCO Club

General: Building 407, constructed in 1969, is a single story, rectangular footprint structure with walls built of cinder block with light red face brick on exposed surfaces. Many areas, such as the Dining Room and the Lounge have floor to ceiling windows covering most of the exterior wall. The roof is a flat, built-up type. The building space consists of a large central ball room, dining room, lounge, multipurpose rooms, kitchen, administrative offices, and service and mechanical rooms. The building has a gross area of approximately 23,600 square feet.

Domestic Hot Water: The building receives high pressure steam of approximately 110 psig from the central plant at Building 447. The steam is then reduced to a lower pressure of approximately 10 psig to serve a semi-instantaneous type domestic hot water generator. The generator consists of a steam-fired instantaneous heater coupled with a 60 gallon storage tank, and is estimated as using 879 lbs/hr of steam to provide 16.7 gpm of hot water at a temperature increase from 40°F to 140°F. The hot water from the generator is supplied through a 1½" pipe for distribution to the building. The generator also has a 1½" recirculating hot water line that returns from the building and connects to the storage tank.

The NCO Club is open from 7:30am to 11:00pm with 50-200 meals served at lunch, 50-100 meals served at dinner, with the buffet serving 150-200 meals per day.

Air Conditioning: The building has a shell and tube steam to hot water converter for building hydronic heating purposes. As with Building 404, there are hot water coils in the air systems which are called "reheat coils" on the construction documents, but further investigation and interview with operations personnel revealed that these coils provide heat in the non-cooling months only. None of the air conditioning systems uses steam for reheat or humidity control purposes.

Other Steam Uses: In the past, the facility had used steam for dishwashing purposes. Presently, the dishwasher has a 10kW electric element in the wash tank and a 14.4kW electric element in the rinse tank. With verification from the manufacturer, the "hot" steam pipe at the dishwasher should not be connected, and there should be no steam consumption. (Except for the cooling effect on the exposed steam pipe.)

7.14 Building 410 - Enlisted Barracks

General: Building 410 appears to be similar in the design and construction as Buildings 402 and 403, however Building 410 is much smaller, being more like one of the typical wings of Building 403. Building 410 has a gross area of approximately 28,800 square feet.

Domestic Hot Water: The domestic hot water demand is met by a horizontal type storage tank generator. The tank has an approximate capacity of 850 gallons and is kept at a temperature of 129°F. The hot water from the generator is supplied through a 2" pipe for distribution to the building. The generator also has a 1½" recirculating hot water line that returns from the building and connects to the storage tank. There are a total of 110 military police personnel that can possibly use the showers in a day. The MP's operate on shifts and with showers being used by 50% of the people in the morning, 25% in the evening and 25% in the early morning.

Air Conditioning: None of the air conditioning systems uses steam for reheat or humidity control purposes.

7.15 Building 411 - Bowling Center

General: Building 411, constructed in 1988, is a single story, rectangular footprint structure with walls built of cinder block with medium red face brick on exposed surfaces. The

building space consists of the bowling lanes, a snack bar, utility areas, and mechanical rooms. The building has a gross area of approximately 18,400 square feet.

Domestic Hot Water: The building receives high pressure steam at approximately 110 psig from the central plant at Building 447. The steam is then reduced to a lower pressure of approximately 7 psig to serve a single 170 gallon tank type hot water generator with an internal heat exchanger. The system was designed to provide 2 gallons per minute of 130°F hot water (with an entering water temperature of 40°F) using 96 pounds of steam per hour. The hot water is supplied from the generator through a 1½" pipe. The generator also has a 1¼" recirculating hot water line that returns from the building.

The Bowling Center is open from 10:00am to 11:00pm Monday through Thursday, 10:00am to 1:00am on Friday and Saturday, and 9:00am-11:00pm on Sunday. Breakfast is also served from 8:30am-10:00am daily.

Air Conditioning: None of the air conditioning systems use steam for reheat or humidity control purposes.

Other Steam Uses: All equipment for food preparation is either electric or gas fired. There are no other uses of steam in Building 411.

7.16 Building 416 - Enlisted Barracks

General: Building 416, constructed in 1975, is a three story structure with walls built of cinder block with light red face brick. The layout of Building 416 differs from the other barracks buildings in that the bedrooms are clustered in groups of four, and each bedroom has its own separate bathroom with a shower and a lavatory. Each cluster is connected to the next with a short corridor. Building 416 has a gross area of approximately 62,900 square feet.

Domestic Hot Water: Building 416 uses a semi-instantaneous type domestic hot water generator to meet the needs of up to 230 people. The generator has 2" hot and cold water connections, a ¾" recirculating hot water line, and a 2½' low pressure steam connection. The storage tank has a 50 gallon capacity and is maintained at 140°F. Adding to the demand, there are also 13 clothes washers located in the central structure.

Air Conditioning: None of the air conditioning systems uses steam for reheat or humidity control purposes.

7.17 Building 423 - Commissary

General: Building 423 has had numerous additions and renovations that have resulted in a irregular and sprawling structure, with dark red face brick walls and roofs of asphalt shingles in most places. The building space consists of the shipping and receiving areas, stocking, meat and vegetable packaging, and the main food aisles. The building has a gross area of approximately 40,000 square feet. After the preliminary phase of this study, it was determined that the Commissary is scheduled for complete demolition within one year. Therefore, direction has been given to delete Building 423 from this energy analysis.

7.18 Building 450 - Main Exchange

General: Building 450, constructed in 1979 with a later addition, is a single story, square footprint structure with walls built of cinder block with dark red face brick on exposed surfaces. The building space consists mainly of the retail sales area with associated spaces including a snack bar, a hair dresser, dry cleaners, utility areas, and mechanical rooms. The building has a gross area of approximately 42,700 square feet.

Domestic Hot Water: The building receives high pressure steam at approximately 110 psig from the central plant at Building 447. The steam is then reduced to a lower pressure of approximately 10 psig to serve a single 500 gallon tank type hot water generator with an internal heat exchanger. The system was designed to provide 3.2 gallons per minute of 140°F hot water (with an entering water temperature of 40°F) using 168 pounds of steam per hour. The hot water is supplied from the generator through a 2" pipe. The generator also has a 1" recirculating hot water line that returns from the building.

The Main Exchange is open from 9:00am to 8:00pm Monday-Friday, 9:00am to 6:00pm on Saturday, and 10:00am-6:00pm on Sunday.

Air Conditioning: The air system serving the Dry Cleaning, Gift Wrapping, Florist, and Snack Bar areas is a variable air volume with reheat type system, however the control system was designed to hold closed all reheat coil valves when the chiller is operating. This effectively prevents summer operation of the reheat system. None of the air conditioning systems uses steam for reheat or humidity control purposes.

Other Steam Uses: All equipment for food preparation at the Snack Bar is either electric or gas fired. The cleaners do not have any on-site presses on steam consuming equipment. There are no other uses of steam in Building 450.

7.19 Building 452 - PX Service Station

General: Although Building 452 has two steam-to-hot water converters, both are used for winter heating demands. According to the original design, one converter serves the heating coil in the air handling unit using 140°F water, and the other serves the garage bay unit heaters using 180°F water. The domestic water heating requirement is satisfied by an electric storage tank type heater. There are no other uses of steam in Building 452.

7.20 Building 469 - Child Care Center

General: Building 469 is a single story, "cross shaped" structure with a gross area of approximately 37,400 square feet that houses three separate organizations. These organizations are the CPO, the Library, and the Child Development Center. There are a total of 150 occupants in the building, 92 of which are children. The Child Development Center has kitchen facilities including a dishwasher and a single clothes washer.

Domestic Hot Water: Domestic hot water is provided to all three users of the building by a single steam fired generator. The generator uses central steam at a reduced pressure of 2 psig and has a 250 gallon tank with an internal heat exchanger. The system was designed to provide 11 gallons per minute of 180°F hot water (with an entering water temperature of 40°F) using 792 pounds of steam per hour. Presently, the generator maintains 140°F hot water. The dishwasher in the kitchen is a manual, single rack type and has an electric booster heater that provides the required 180°F rinse water.

Air Conditioning: None of the air conditioning systems uses steam for reheat or humidity control purposes.

Other Steam Uses: All kitchen equipment is either gas or electric. There are no other uses of steam in Building 469.

7.21 Building 501 - Tencza Terrace

General: Building 501, constructed in 1964, is a 12 story, high rise apartment building built of reinforced concrete with an unfinished exterior surface. The building space consists of apartment units, ten per floor, and the basement which houses the mechanical equipment, tenant storage, and clothes washers and dryers. The building has a gross area of approximately 145,000 square feet.

Domestic Hot Water: The building receives high pressure steam at approximately 105 psig from the central plant at Building 447. The steam is then reduced to a lower pressure of approximately 15 psig to serve a single instantaneous type hot water generator. The system is rated to provide 90 gallons per minute of 120°F hot water (with an entering water temperature of 40°F) using 3,180 pounds of steam per hour. The hot water is supplied from the generator through a 2½" pipe.

Air Conditioning: None of the air conditioning systems uses steam for reheat or humidity control purposes.

Other Steam Uses: There are no other uses of steam in Building 501.

7.22 Building 525 - Rader Clinic

General: Building 525, constructed in 1965, is a two story, square footprint structure with walls built of cinder block with light beige face brick on exposed surfaces, and precast concrete stucco panels below window areas. The windows are double pane, grey tinted in metal frames. Some of the windows are operable. The roof is a flat, built-up type, with copper facias. The building space consists of various medical examining rooms, a dental clinic, auxiliary support spaces, and the mechanical room. The building has a gross area of approximately 55,100 square feet.

Domestic Hot Water: The building receives high pressure steam from the central plant at Building 447. The steam is then reduced to a lower pressure of approximately 8 psig to serve a semi-instantaneous type domestic hot water generator. The generator consists of a steam-fired instantaneous heater coupled with a 80 gallon storage tank, and is estimated as using 1,414 lbs/hr of steam to provide 27 gpm of hot water at a temperature increase from 40°F to 140°F. The hot water from the generator is supplied through a 1½" pipe for distribution to the building. The generator also has a 1¼" recirculating hot water line that

returns from the building. Where needed, higher temperature water is boosted to sterilizing temperatures by electric equipment at the specific location in the building.

The Clinic is open from 7:30am to 4:00pm Monday through Friday, and is closed on weekends. The x-ray department, however, is a 24-hour operation.

Air Conditioning: The building has one shell and tube steam to hot water converter for building hydronic heating and hydronic reheat purposes. There are two constant volume air handling units that serve the entire building. In these systems there are a total of 76 reheat coils, which cover virtually every occupied space in the building. The reheat systems serve to maintain specific dry bulb temperatures within each zone.

Through the computer simulation of these reheat systems, the calculated reheat energy demand for the summer period is 1,687 MBTU (million British Thermal Units).

Other Steam Uses: There are no other uses of central steam in Building 525.

8. IMPLEMENTATION OF ALTERNATIVES

8.1 General:

In several of the larger barracks buildings, and a few other buildings, older storage type domestic hot water heating systems had been replaced with instantaneous (or semi-instantaneous) heaters possibly due to the availability of central steam. In attempting to provide adequate steam to these instantaneous heaters and maintain the present level of service, boilers as large as up to ten times the hourly demand capacity would have to be installed. This presents numerous physical conflicts between the boilers and the limited existing spaces, and which if resolved, would create excessive construction costs. These costs include the larger boilers, associated equipment, and architectural modifications or construction of entirely new structures that will be required to house these boilers and other pieces of equipment.

In terms of energy efficiency, taking an instantaneous approach to meeting a hot water demand does not consider that a duration of peak use will be followed by an extended period of low use, and consequently, an opportunity for balanced recovery. Thus, instantaneous equipment allows for a peak condition to be met indefinitely and does not encourage users into using energy efficiently. Current Army Technical manual 5-810-5 provides for sizing equipment using storage capacity and taking durations of peak use into consideration. This practice leads to equipment of significantly smaller capacities that can be placed in the existing mechanical rooms in a straight forward manner, and more importantly, will not allow for an unrestricted use of hot water.

A supplemental item to the downsizing of the equipment is that most of the buildings are currently using hot water of 120°F to 140°F. Presently, Army regulations provide for a temperature of 95°F at the point of use for general domestic washing applications. The calculations for this study use storage tank temperatures of 100°F to 110°F. Theoretically, this leads to an energy savings or equipment firing capacity reduction of up to 40%,

excluding savings due to lower standby losses in the lower temperature system and the effect of storage mentioned above. In this analysis, providing hot water storage and reducing the hot water temperatures in accordance with the regulations resulted in an installed firing capacity reduction of over 70%.

Applications that require elevated temperatures, such as dishwashing, use existing local temperature boosting equipment which is generally steam fired. In some cases, temperature boosting is handled by electric equipment. The tables in the following two pages show a comparison of the present equipment capacities to those of the equipment proposed in Alternative 1. These tables are reproduced from Volume III: Engineering Calculations, Section H "Summer Energy Demands & Consumption." Refer to Volume III for supporting calculations, assumptions, and additional cross references.

Peak Equipment Requirements (Present Operation)

Building Number	Utilization	Domestic Hot Water Heating			Other Requirements			Total Peak Requirement
		Heat (kBTU/hr)	Steam (psig)	Steam (lbs/hr)	Heat (kBTU/hr)	Steam (psig)	Steam (lbs/hr)	(kBTU/hr)
246	Enlisted Barracks	7,800.0	10	8,552	108.8	85	121	7,909
247	Enlisted Barracks	1,985.5	11	2,090	100.4	85	112	2,086
248	Enlisted Barracks	3,970.0	11	4,179	209.2	85	232	4,179
249	Enlisted Barracks	183.3	8	192	0.0	---	0	183
250	Enlisted Barracks	2,245.2	8	2,351	66.9	85	74	2,312
251	Enlisted Barracks	720.8	8	755	100.4	85	112	821
400	Band	300.0	8	315	467.0	8	486	767
402	Enlisted Barracks	4,000.0	20	4,255	66.9	85	74	4,067
403	Enlisted Barracks	4,950.0	20	5,266	0.0	---	0	4,950
404	Dining Facility	7,500.0	10	7,895	2,178.2	15	2,305	9,678
405	Recreation Center	91.7	10	97	0.0	---	0	92
406	Enlisted Barracks	4,950.0	20	5,266	0.0	---	0	4,950
407	NCO Club	835.0	10	879	0.0	---	0	835
410	Enlisted Barracks	990.0	10	1,042	33.5	85	37	1,024
411	Bowling Center	91.5	7	96	0.0	---	0	92
416	Enlisted Barracks	525.0	10	551	0.0	---	0	525
423	Commissary	398.9	10	419	0.0	---	0	399
450	Main Exchange	160.0	10	168	0.0	---	0	160
452	PX Service Station	0.0	---	0	0.0	---	0	0
469	Child Care Center	387.9	8	402	0.0	---	0	388
501	Tencza Terrace	3,600.0	15	3,810	0.0	---	0	3,600
525	Rader Clinic	1,350.0	8	1,414	1,272.7	8	1,326	2,623
							Grand Total =	51,639

Minimum Equipment Requirements: Domestic Hot Water & Steam

Building Number	Utilization	Domestic Hot Water Heating					Other Steam Requirements			Total Output Energy Requirement (kBTU/hr)
		Storage (gallons)	Recovery (gal/hr)	Heat (kBTU/hr)	Steam * (lbs/hr)	Pressure * (psig)	Steam (lbs/hr)	Pressure (psig)	Heat (kBTU/hr)	
246	Enlisted Barracks	853	977.8	488.9	471	10	121	85	108.8	597.7
247	Enlisted Barracks	221	253.2	126.6	133	11	112	85	100.4	227.0
248	Enlisted Barracks	324	371.0	185.5	195	11	232	85	209.2	394.7
249	Enlisted Barracks	141	161.5	80.8	85	8	0	---	0.0	80.8
250	Enlisted Barracks	316	362.3	181.2	190	8	74	85	66.9	248.1
251	Enlisted Barracks	457	523.8	261.9	274	8	112	85	100.4	362.3
400	Band	200	233.3	116.7	122	8	486	8	467.0	583.7
402	Enlisted Barracks	952	1,091.3	545.6	581	20	74	85	66.9	612.6
403	Enlisted Barracks	2,000	2,291.7	1145.8	872	20	0	---	0.0	1,145.8
404	Dining Facility	2,000	2,600.0	1300.0	1,365	10	2,305	15	2,178.2	3,478.2
405	Recreation Center	211	246.3	123.1	33	10	0	---	0.0	123.1
406	Enlisted Barracks	1,429	1,636.9	818.5	872	20	0	---	0.0	818.5
407	NCO Club	267	346.7	173.3	182	10	0	---	0.0	173.3
410	Enlisted Barracks	419	480.2	240.1	172	10	37	85	33.5	273.6
411	Bowling Center	173	108.3	54.2	57	7	0	---	0.0	54.2
416	Enlisted Barracks	880	1,008.3	504.2	307	20	0	---	0.0	504.2
423	--- Deleted ---	0	0.0	0.0	---	---	0	---	0.0	0.0
450	Main Exchange	422	263.9	131.9	138	10	0	---	0.0	131.9
452	PX Service Station	0	0.0	0.0	---	---	0	---	0.0	0.0
469	Child Care Center	300	300.0	175.0	130	2	0	---	0.0	175.0
501	Tencza Terrace	3,200	4,000.0	2333.3	2,116	15	0	---	0.0	2,333.3
525	Rader Clinic	747	871.1	508.1	456	8	1,326	8	1,272.7	1,780.8
									Grand Total (Equipment Capacities)	14,098.8

* Data provided for option to reuse existing steam-fired domestic hot water heating equipment during the summer period

8.2 Alternative 1:

The estimated total investment cost for this alternative is $954,240 in fiscal year 1994 dollars. If implemented, this alternative is estimated to yield a total cost savings of $461,035 and a total energy savings of 38,799 MBTU annually. According to the ECIP analysis, these savings would generate a savings to investment ratio of 7.45 with a simple payback of 2.07 years.

In the "Old Guard" barracks (Buildings 246, 247, 248, 249, 250, and 251), there appears to be adequate space for local boilers in the basements. Due to the demand of both domestic hot water and high pressure steam, a more expensive, steel high-pressure steam boiler must be installed. Further, access to the basement is limited to single width doorways as disturbing the stone, load-bearing walls is not recommended. This limits the width of the boilers, tanks, and other equipment to 38 inches. All equipment, when limited to 38 inches in width, could then be brought through the 40 inch door openings. The door openings, however, would have to be made clear by temporarily removing the wooden doors and frames.

As the typical barracks load consists of both a high pressure steam demand and a domestic hot water demand, it could be possible to provide a dedicated high pressure boiler for the steam presses, joined with a less expensive low pressure boiler to meet the hot water demand. This option is not beneficial, however, because in each situation, the cost of two boilers is not significantly different than that of a single full sized high pressure boiler. Typically, the small sized high pressure boiler would cost approximately $4,900 and a suitable low pressure boiler would cost approximately $3,500 for a total equipment cost of $8,400. The cost of a full sized high pressure boiler would be approximately $8,000. As there is no appreciable cost difference, other considerations such as associated equipment, floor space, and maintenance and operation make a single boiler operation more desirable. (This discussion also applies to Alternative 3, and shows that it is not practical to use electric boilers for small amounts of steam when there is also a large low pressure steam demand.)

It should be noted that each of the "Old Guard" barracks (Buildings 246, 247, 248, 249, 250, and 251) originally housed coal-fired boiler equipment for heating purposes, since they were constructed decades prior to central steam facilities. Since then, the old equipment has been removed and has not been replaced. Therefore, much of this space is now available for local steam generating equipment. Also, the existing brick chimneys on the "Old Guard" barracks buildings can be reused as chases for the new boiler flues. In keeping with the historical character of these buildings, the flues should be terminated flush with the top of the chimney stacks so that the stainless steel flue material will not be visible on the building exterior. Also, the flue should not have a vent cap at the termination. A means of positive drainage from the flue into the existing chimney should be provided in the flue elbow at the base of the stack. At some point, Building 250 had its chimneys demolished, except for the bottom five feet at the basement level. In this building, a suitable boiler installation would include a new masonry chase connecting to a new red brick chimney above the roof which matches the style and appearance of the existing chimneys. The stainless steel boiler flue in Building 250 would be installed in this new chase in the same manner as the flues in the other "Old Guard" barracks use those existing chimneys.

In a typical arrangement for all of the barracks buildings in this study, the summer boilers would supply the existing steam-to-water converters, and steam presses or other devices as required, by connecting to the high pressure steam lines, downstream of the main valves and ahead of the pressure reducing station. The new domestic hot water storage tanks would be installed downstream of the water heater and valved so that they may be taken out of service without disrupting hot water flow in the buildings.

In applications where only low pressure steam is required, the connection to the existing steam piping may be made on the low pressure side of the pressure reducing stations. Further, in the smaller capacity applications where a domestic water heater is more suitable than a steam boiler, the steam systems should be bypassed entirely and the connections from the summer heating equipment should be made directly to the domestic hot water systems, downstream of the existing steam-fired heaters.

In the applications that are too large for a domestic water heater to be practical, yet require only low pressure steam, a cast iron sectional boiler has been selected. Cast iron boilers have been selected where demands are greater than 1,500 MBH (kBTU/hr).

In buildings other than the "Old Guard" barracks, the typical boiler flue installation that would be required consists of running a double-wall galvanized steel vent at the ceiling of the basement space, penetrating the nearest outer wall, provided that it is not in the front of the building, and run exposed vertically to a height of three feet above any roof surface within ten feet horizontally. In some of the single story buildings, it is possible to simply extend the vent up from the boiler or water heater, with an offset as required by structural members in the roof, penetrate the roof and extend to the required height of three feet above any roof surface within ten feet horizontally. In the modern barracks buildings 402, 403, and 406, and also in building 501 (Tencza Terrace), it is possible to run the new boiler flues in existing fire-rated chases located adjacent to the main stairwells. This opportunity to reuse the existing chases will improve the aesthetics of these buildings, and will save the costs associated with enclosing exterior vertical flues in materials that match the existing building exteriors; if concealed flues were to be desired. Sketches of the more difficult boiler installations outlined above are included in Appendix D "Programming Documents."

Although some of the buildings have existing natural gas service, all of the buildings will require new services to provide adequate supplies to the summer heating equipment. Because Washington Gas does not view the new installations as producing new revenues (since the main boilers in Building 447 will not be operating), there will be additional construction costs for the new services. These costs as provided by Washington Gas are included in Volume III: Engineering Calculations.

After the equipment is installed, routine maintenance operations will be required. The buildings provided with domestic water heaters will require a monthly visit to verify the correct operation of the equipment and provide an opportunity to make minor adjustments. In the off-season, the water heaters will require an overhaul which is estimated as a two hour

service to lubricate, flush and restore the equipment. Buildings with low pressure steam boilers will require weekly operational visits, a six hour off-season overhaul including gasket replacement, and also water treatment service consisting of sampling and testing of water and checking of automatic feeder equipment three times weekly. Buildings with high pressure boiler installations will require the same maintenance as those with low pressure boilers but with operational visits on a daily basis, and the addition of semi-annual inspections by a recognized and approved insurance company.

8.3 Alternative 2:

The estimated total investment cost for this alternative is $956,480 in fiscal year 1994 dollars. If implemented, this alternative is estimated to yield a total cost savings of $461,730 and a total energy savings of 38,946 MBTU annually. According to the ECIP analysis, these savings would generate results that match those of Alternative 1, with a savings to investment ratio of 7.45 and a simple payback of 2.07 years.

The difference between this alternative and Alternative 1 is to provide for all of the steam demands of Barrack Buildings 246, 247, 248, 250, and 251 through the use of one semi-central boiler. The remaining buildings of this study are provided for by individual boilers as outlined in Alternative 1.

There are two requirements for the selection of the type of boiler for the semi-central service. The boiler must be high pressure generating to handle the requirements of the steam presses, and the boiler must be large enough to handle the peak domestic hot water requirement of each building because those loads will be concurrent. The semi-central boiler system serving the "Old Guard" barracks has been analyzed with the provision of two boilers to be operated in a back-up or redundant fashion. If the barracks were to depend on one boiler for their entire needs, there would be a greater chance of a breakdown affecting all of these barracks than with an independent boiler for each building as provided in Alternative

1. Therefore, to yield an accurate comparison, only viable installations could be considered. In addition, a separate structure to house the semi-central boilers would be required. This structure would be located behind the "Old Guard" buildings. This could detract from the appearance of the post from the outside (Arlington Boulevard exposure), and would limit any future use of this space.

The new boiler system would connect into the existing steam distribution system in order to serve the buildings. Additional main sectionalizing valves would be added to the existing piping at both ends of the steam branches serving the area to contain the steam for the summer system.

8.4 Alternative 3:

The estimated total investment cost for this alternative is $1,002,400 in fiscal year 1994 dollars. If implemented, this alternative is estimated to yield a total cost savings of $442,790 and a total energy savings of 38,999 MBTU annually. According to the ECIP analysis, these savings would generate a savings to investment ratio of 6.86 with a simple payback of 2.26 years.

This alternative uses the methods described in Alternative 1 to provide local steam and hot water generation, with the exception of using electric powered equipment where possible to reduce the investment costs.

The limiting factors for selecting buildings to be served by electric powered equipment are the initial cost of the equipment, cost of electricity to operate the equipment, and the need to upgrade existing electric service to the building. In the Army Corps of Engineers Technical Manual 5-810-5, paragraph 4-4.c.2 provides that "because of the high operating cost of electrical equipment, electricity is not used for large-volume water heating when natural gas is available." In buildings with larger demands, electric equipment and the

associated electric service upgrades become more expensive than the comparable gas-fired equipment, and utility costs of electricity are a minimum of three times greater than gas.

The discussion under the implementation of Alternative 1 regarding the use of dual boiler systems in the "Old Guard" barracks also applies to the selection of electric equipment, where electric boilers could be used to serve the high pressure demands of the steam presses. For the same reasons as stated previously, and compounded with increased energy use costs, this arrangement is not beneficial.

Only six of the buildings were suitable for the electric water heater installations.

8.5 Alternatives 4a and 4b:

The estimated total investment cost for Alternative 4a is $1,013,600 in fiscal year 1994 dollars. If implemented, this alternative is estimated to yield a total cost savings of $462,069 and a total energy savings of 38,957 MBTU annually. According to the ECIP analysis, these savings would generate a savings to investment ratio of 7.03 with a simple payback of 2.19 years.

The estimated total investment cost for Alternative 4b is $1,015,840 in fiscal year 1994 dollars. If implemented, this alternative is estimated to yield a total cost savings of $462,776 and a total energy savings of 39,104 MBTU annually. According to the ECIP analysis, these savings would generate a savings to investment ratio of 7.04 with a simple payback of 2.20 years.

These alternatives use the methods described in Alternative 1 to provide local steam and hot water generation, with the exception of using high efficiency pulse-type gas fired equipment where possible to reduce the operating costs through improved use of fuel.

The limiting factor in applying the high efficiency equipment is the relatively small capacities available for this type of equipment. It is possible to place several high efficiency units together to operate as a staged system. For this study, installations with up to six modular units have been analyzed to determine the feasibility. Beyond this collective size of 600 MBH (kBTU/hr) input, the systems tend to become complex when the intent is to have a single unit in operation, and recovering the initial costs becomes an extended process. Only seven of the buildings were suitable for the high efficiency gas boiler installations.

In the high efficiency installations, the exhaust gases are vented to the atmosphere through non-corroding PVC plastic pipe. Also, provisions for handling the corrosive condensate through a drainage system must be installed with these units.

APPENDIX A

SCOPE OF WORK

920022cc

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, U.S. ARMY CORPS OF ENGINEERS
P.O. BOX 1715
BALTIMORE, MD 21203-1715

REPLY TO
ATTENTION OF

July 21, 1992

Engineering Division
Design Branch

Mr. Virender Puri
President
Engineering Applications
Consultants
9004-B Crownwood Court
Burke, Virginia 20215-1630

Dear Mr. Puri:

This is in reference to your meeting with Mr. James Hawk, Project Manager for this office, on July 6, 1992, concerning the Energy Savings Opportunity Survey, at Fort McNair, Washington DC; Fort Belvoir, Virginia and DeWitt Army Hospital Fort Belvoir, Virginia Contract No. DACA31-89-C-0198. As a result of this meeting understandings gotten in our letter of July 1, 1992 are reinstated or modified as follows:

a. The Fort Myer portion of the original contract executed in 1989 was discussed in detail.

b. A portion of the work at Fort Myer, Virginia that was included in the basic contract, but not funded due to fiscal restraints, was then discussed.

c. Mr. James Hawk advised you that a portion of the work at Fort Myer, Virginia included under the original contract but not funded will now be added to your contract as a modification under the Fort McNair portion of your contract. The energy study that was at Fort Myer, Virginia when the original contract was executed is now being administered by the energy officer at Fort McNair, Washington DC.

d. The scope of work for this modification was discussed in detail as follows:

(1) PURPOSE: The purpose of this modification is to evaluate the feasibility of providing local means of generating hot water or steam to each building, and shutting down the central heating plant in Building 447 during summer. As a result of this study, develop programming documents for funding under PECIP, ECIP, or QRIP programs.

(2) DESCRIPTION OF WORK:

(a) The following is a list of buildings requiring hot water or steam during summer. Buildings designated with an * shall be surveyed to develop summer steam or hot water usage:

BUILDING NUMBER	UTILIZATION	REQUIREMENT
*246	Enlisted Barracks	Hot Water, Steam Generator
247	Enlisted Barracks	Hot Water, Steam Generator
248	Enlisted Barracks	Hot Water, Steam Generator
*249	Enlisted Barracks	Hot Water, Steam Generator
250	Enlisted Barracks	Hot Water, Steam Generator
251	Enlisted Barracks	Hot Water, Steam Generator
*400	Band	Hot Water, Steam Generator
*402	Enlisted Barracks	Hot Water, Reheat Coils
403	Enlisted Barracks	Hot Water
*404	Dining Facility	Hot Water
405	Recreation Center	Hot Water, Steam Generator
406	Enlisted Barracks	Hot Water
*407	NCO Club	Hot Water
410	Enlisted Barracks	Hot Water, Steam Generator
*411	Bowling Center	Hot Water, Steam Generator
416	Enlisted Barracks	Hot Water
*423	Commissary	Hot Water
*450	Main Exchange	Hot Water
452	PX Service Station	Hot Water
469	Child Care Center/CPO	Hot Water
*501	Tencza Terrace	Hot Water
*525	Rader Clinic	Hot Water, Steam Generator

(b) Obtain and review drawings of each building. Conduct discussions with maintenance personnel to discuss hot water or steam usage and operating characteristics of each building.

(c) Survey every building to develop summer hot water or steam usage.

(d) For all buildings, consider gas boilers. There is existing gas distribution on the site. Consider extending gas from the curbside to each boiler. Where the Army criteria permits, evaluate electric steam generators.

(e) In Buildings, 246, 247, 248, 250, 251, and 410, consider two alternatives for generating hot water or steam for summer use. The first alternative will analyze individual boiler (steam generator) for each building. The second alternative will analyze one central boiler for all of these buildings. Two locations for the central boiler will be analyzed.

(f) In all remaining buildings, consider one individual boiler for each building.

(g) Consider condensing type gas furnaces where applicable.

(h) Conduct survey to verify summer hot water or steam usage. Evaluate space requirements for locating boilers, steam generators, interconnections to the steam lines, and the entrance-ways for the extension of gas service.. Survey electric service for connections to electric steam generators.

(i) Review the operation of the boiler plant to develop the operating and maintenance cost of the boiler plant, specifically during summer.

(j) Buildings not designated for a full survey shall be included in the programming documents as similar to the ones surveyed. Sketches, equipment identification and any other information needed to complete the programming documents in determining energy savings will be required under this contract.

(3) ENGINEERING STUDY: Prepare an engineering study as per the requirements outlined in Contract DACA31-89-C-0198.

(4) GOVERNMENT RESPONSIBILITY:

(a) Provide access to the building mechanical and electrical rooms at reasonable hours.

(b) Make maintenance personnel and use representative available for discussion.

(c) Provide drawings of the buildings showing the existing steam system.

(d) Provide boiler plant logs, fuel rates and maintenance costs.

If you have any questions concerning the above understandings please call Mr. Hawk at 410-962-3774.

Sincerely,

Stanley N. Block, P.E.
Acting Chief, Design Branch
Engineering Division

SCOPE OF WORK
FOR AN
ENERGY SAVINGS OPPORTUNITY SURVEY (ESOS)

ENERGY ENGINEERING ANALYSIS PROGRAM

Fort McNair, Washington, DC

Fort Myer, VA

Fort Belvoir, VA

TABLE OF CONTENTS

1. BRIEF DESCRIPTION OF WORK: The Architect-Engineer (AE) shall:

1.1 Review for general information the previously completed Energy Engineering Analysis Program (EEAP) study and any other energy studies which were performed at this installation.

1.2 Reevaluate selected projects and energy conservation opportunities (ECOs) from the previous studies to determine their economic feasibility based on revised criteria, current site conditions and technical applicability.

1.3 Evaluate selected ECOs to determine their energy savings potential and economic feasibility.

1.4 Perform a limited site survey of selected buildings as detailed in Annexes A1, A2, & A3 [redacted] to insure that any specific methods of energy conservation which are practical and have not been evaluated in any previous energy study have been considered and the results documented.

1.5 Provide complete programming or implementation documentation for all recommended ECOs.

1.6 Prepare a comprehensive report to document the work performed, the results and the recommendations.

2. GENERAL

2.1 Other studies performed under the EEAP have been performed at this installation. Criteria for both the study and the resulting documentation has changed since the previous study was completed. This study is intended to reevaluate selected projects from the previous study which have not been implemented nor programmed for implementation and to consider specific ECOs in buildings and areas that may have been overlooked previously or recently identified.

2.2 The information and analysis outlined herein are considered to be minimum essentials for adequate performance of this study.

2.3 The AE shall ensure that all methods of energy conservation which will reduce the energy consumption of the installation in compliance with the Energy Resources Management Plan including those listed in Annexes A1, A2, & A3 have been considered and documented. All methods of energy improvements of operational methods and procedures as well as the physical facilities. All energy conservation opportunities which produce energy or dollar savings shall be documented in this report. Any energy conservation opportunity considered infeasible shall also be documented in the report with reasons for elimination. ~~A list of general conservation opportunities (ECOs) to be used when evaluating specific buildings or areas is included as Annexes A1, A2, & A3.~~ conservation which are reasonable and practical shall be considered including

A3 to this scope. Annexes A1, A2, and A3 contain a list of ECOs specifically for this installation. [redacted] these lists shall be considered and the evaluation of each ECO documented in the report. Those lists are not intended to be restrictive but only to assure that basic and generally repetitive opportunities are addressed in the report. Some of the energy conservation opportunities in Annexes A, B, & C may not be applicable to the specific building or area at this installation. A statement to that effect is all that is required.

2.4 The study shall include the energy consuming buildings or areas listed in Annexes A1, A2, & A3. The work in the areas may be reduced somewhat by building repetition.

2.5 The study shall consider the use of all energy sources. The energy sources may include electricity, natural gas, liquefied petroleum gas, bulk oil, other oil products, steam when procured, gasoline, coal, solar, etc.

2.6 The "Energy Conservation Investment Program (ECIP) Guidance", CEHSC-FU-P, 15 June 89, described in letter from CEHSC-FU, dated 25 April 1988, establishes criteria for ECIP projects and shall be used for performing the economic analyses of all ECOs and projects. Construction cost escalation for DD Form 1391 sub mission shall be calculated using the guidelines contained in AR 415-17 and the latest Tri-Service MCP Index. The Tri-Service MCP Index, when updated, is contained in the latest applicable edition of the Engineer Improvement Recommendation System (EIRS) bulletin.

2.7 Energy conservation opportunities determined to be technically and economically feasible shall be developed into projects acceptable to installation personnel. This may involve combining similar ECOs into larger packages which will qualify for ECIP or MCA funding, and determining, in coordination with installation personnel, the appropriate packaging and implementation approach for all feasible ECOs.

2.8 Projects which qualify for ECIP funding shall be identified, separately listed, and prioritized by the Savings to Investment Ratio (SIR).

2.9 All feasible non-ECIP projects shall be ranked in order of highest to lowest SIR.

2.10 At some installations Energy Conservation and Management (ECAM) funding will be used instead of ECIP funding. The criteria for each program is the same. The Director of Engineering and Housing will indicate which program is used at this installation. This Scope of Work mentions only ECIP, however, ECAM is also meant.

3. PROJECT MANAGEMENT

3.1 Project Managers. The AE shall designate a project manager to serve as a point of contact and liaison for work required under this contract. Upon award of this contract, the individual shall be immediately designated in writing. The AE's designated project manager shall be approved by the Contracting Officer prior to commencement of work. This designated individual shall be responsible for coordination of work required under this contract.

The Contracting Officer will designate a project manager to serve as the Government's point of contact and liaison for all work required under this contract. This individual will be the Government's representative.

3.2 Installation Assistance. The Commanding Officer at each installation will designate an individual who will serve as the point of contact for obtaining information and assisting in establishing contacts with the proper individuals and organizations as necessary to accomplish the work required under this contract.

3.3 Public Disclosures. The AE shall make no public announcements or disclosures relative to information contained or developed in this contract, except as authorized by the Contracting Officer.

3.4 Meetings. Meetings will be scheduled whenever requested by the AE or the Contracting Officer for the resolution of questions or problems encountered in the performance of the work. The AE and/or the designated representative(s) shall be required to attend and participate in all meetings pertinent to the work required under this contract as directed by the Contracting Officer. These meetings, if necessary, are in addition to the presentation and review conferences.

3.5 Site Visits, Inspections, and Investigations. The AE shall visit and inspect/investigate the site of the project as necessary and required during the preparation and accomplishment of the work.

3.6 Records

3.6.1 The AE shall provide a record of all significant conferences, meetings, discussions, verbal directions, telephone conversations, etc., with Government representative(s) relative to this contract in which the AE and/or designated representative(s) thereof participated. These records shall be dated and shall identify the contract number, and modification number if applicable, participating personnel, subject discussed and conclusions reached. The AE shall forward to the Contracting Officer within ten calendar days, a reproducible copy of the records.

3.6.2 The AE shall provide a record of requests for and/or receipt of Government-furnished material, data, documents, information, etc., which if not furnished in a timely manner, would significantly impair the normal progression of the work under this contract. The records shall be dated and shall identify the contract number and modification number, if applicable. The AE shall forward to the Contracting Officer within ten calendar days, a reproducible copy of the record of request or receipt of material.

3.7 Interviews. The AE and the Government's representative shall conduct entry and exit interviews with the Director of Engineering and Housing before starting work at the installation and after completion of the field work. The Government's representative shall schedule the interviews at least one week in advance.

3.7.1 Entry. The entry interview shall thoroughly brief and describe the intended procedures for the survey and shall be conducted prior to commencing work at the facility. As a minimum, the interview shall cover the following points:

a. Schedules.

b. Names of energy analysts who will be conducting the site survey.

c. Proposed working hours.

d. Support requirements from the Director of Engineering and Housing.

3.7.2 Exit. The exit interview shall include a thorough briefing describing the items surveyed and probable areas of energy conservation. The interview shall also solicit input and advice from the Director of Engineering and Housing.

4. SERVICES AND MATERIALS. All services, materials (except those specifically enumerated to be furnished by the Government), plant, labor, superintendence and travel necessary to perform the work and render the data required under this contract are included in the lump sum price of the contract.

5. PROJECT DOCUMENTATION. All energy conservation opportunities (ECOs) which the AE has considered shall be included in one of the following categories and presented in the report as such:

5.1 ECIP Projects. To qualify as an ECIP project, an ECO, or several ECOs which have been combined, must have a construction cost estimate greater than $200,000, a Savings to Investment Ratio (SIR) greater than one and a simple payback period of less than eight years. For ECAM and family housing projects, the $200,000 limitation may not apply. The AE shall check with the installation for guidance. The overall project and each discrete part of the project shall have a SIR greater than one. For all projects meeting the above criteria, complete programming documentation will be required. Programming documentation shall consist of a DD Form 1391, life cycle cost analysis summary sheet(s) (with necessary backup data to verify the numbers presented), and a project development brochure (PDB). A life cycle cost analysis summary sheet shall be developed for each ECO and for the overall project when more than one ECO is combined. For projects and ECOs reevaluated from the previous studies, the backup data shall consist of copies of the original calculations and analysis, with new pages revising the original calculations and analysis. In addition, the backup data shall include as much of the following as is available: the increment of work the project or ECO was developed under in the previous study, title(s) of the project(s), the energy to cost (E/C) ratio, the benefit to cost (B/C) ratio, the current working estimate (CWE), and the payback period. This information shall be included as part of the backup data. The purpose of this information is to provide a means to prevent duplication of projects in any future reports.

5.2 Non-ECIP Projects. Projects which normally do not meet ECIP criteria, but which have an overall SIR greater than one shall be documented. The life cycle cost analysis summary sheet shall be completed through and including line 6 for all projects or ECOs. Each shall be analyzed to determine if they are feasible even if they do not meet ECIP criteria. These ECOs or projects may not meet the nonenergy qualification test. For projects or ECOs which meet this criteria, the life cycle cost analysis summary sheet, completely filled out, with all the necessary backup data to verify the numbers presented, a complete description of the project and the simple payback period shall be included in the report. Additionally, these projects shall have the necessary documentation prepared, in accordance with the requirements of the Government's representative, for one of the following categories:

a. Quick Return in Investment Program (QRIP). This program is for projects which have a total cost less than $100,000 and a simple payback period of two years or less.

b. OSD Productivity Investment Funding (OSD PIF). This program is for projects which have a total cost greater than $100,000 and a simple payback period of four years or less.

c. Productively Enhancing Capital Investment Program (PECIP). This program is for projects which have a total cost greater than $100,000 and a simple payback period of four years or less.

The above programs are all described in detail in AR 5-4, Change No. 1.

d. Regular Military Construction Army (MCA) Program. This program is for projects which have a total cost greater than $200,000 and a simple payback period of eight to twenty-five years. Projects or ECOs which qualify for this program shall be economically analyzed in accordance with the requirements for Special Directed Studies in Engineering Technical Letter (ETL) 1110-3-332.

e. Low Cost/No Cost Projects. These are projects which the Director of Engineering and Housing can perform using his resources.

5.3 Nonfeasible ECOs. All ECOs which the AE has considered but which are not feasible, shall be documented in the report with reasons and justifications showing why they were rejected.

6. DETAILED SCOPE OF WORK. The general Scope of Work is intended to apply to contract efforts for all Army installations included under this contract except as modified by the detailed Scope of Work for each individual installation. The detailed Scope of Work is contained in Annexes #A1, A2 & A3

7. WORK TO BE ACCOMPLISHED.

7.1 Review Previous Studies. The AE shall review for general information the previous EEAP study along with any other energy studies performed at the installation. This review should acquaint the AE with the work that has been performed previously. Much of the information the AE may need to develop the

ECOs in this project will be contained in the previous studies. The survey data contained in the previous study should be very helpful to the results of this study.

7.2 Reevaluate Selected Projects. The AE shall reevaluate the projects and ECOs listed in Annexes A1, A2, & A3. These projects and ECOs are projects and ECOs that the previous study has identified but that have not been accomplished or only parts have been accomplished. If the project or ECO is acceptable as is, that is, there are no changes to the basic project or ECO, the energy savings shown in the previous project may be accepted as accurate but the energy cost and construction cost estimates shall be updated based on the most current data available. With the above information the project shall then be analyzed based on current ECIP criteria. If the project or ECO is basically acceptable but some of the buildings in the original project have been deleted or new buildings can be added, the necessary changes shall be made to the energy saving, the energy costs and construction costs shall be updated and the revised project or ECO shall then be analyzed using current ECIP guidance. If the original project or ECO has had numerous changes made to it so that all of the numbers are suspected of being inaccurate, but the project or ECO is still considered feasible, the AE shall develop the project from the beginning and analyze it with the current ECIP guidance. These projects shall be separately listed in the report.

A1, A2 & A3 7.3 Evaluate Selected ECOs. The AE shall analyze the ECOs listed in Annex B. These ECOs shall be analyzed in detail to determine their feasibility. Savings to Investment Ratios (SIRs) shall be determined using current ECIP guidance. The necessary data required for these projects may not be available, requiring the AE to visit the installation to obtain any necessary information. The AE shall provide all data and calculations needed to support the recommended ECO. All assumptions shall be clearly stated. Calculations shall be prepared showing how all numbers in the ECO were figured. Calculations shall be an orderly step-by-step progression from the first assumption to the final number. Descriptions of the products, manufacturers catalog cuts, pertinent drawings and sketches shall also be included. A life cycle cost analysis summary sheet shall be prepared for each ECO and included as part of the supporting data. For ECOs which would replace the existing heating, ventilating, and air conditioning (HVAC) system or significantly change it (such as converting a multizone system to a variable air volume (VAV system)) the AE is required to run a computer simulation to analyze the system and to determine the energy savings. This requirement to use computer modeling applies only to heated and air conditioned or air conditioned only buildings which exceed 8,000 square feet or heated only buildings in excess of 20,000 square feet. The computer program shall analyze the building on an hour-by-hour basis rather than the bin data method or bin data to simulate an hour-by-hour analysis. Unless the Building Loads Analysis and System Thermodynamic (BLAST) program is used, the AE shall submit a sample computer run with an explanation of all input and output data and a summary of program methodology and energy evaluation capabilities for approval by the Contracting Officer prior to use of the program for analysis. The computer program used must be comparable to the BLAST program. The use of the LCCID computer program may be used if requested in writing.

7.4 Perform a Limited Site Survey. The AE shall conduct a limited site survey to evaluate the buildings or areas listed in Annexes A1, A2, & A3. The list of ECOs in Annexes A1, A2, & A3 shall be used when evaluating these building or areas. This list is not intended to be restrictive but only to assure that these opportunities, as a minimum, are considered, discussed and documented in the report. The AE may be aware of other ECOs not included in Annexes A1, A2, & A3 that will produce energy, manpower or dollar savings. These should be evaluated the same4 as the other ECOs. Each of the items shall be considered and discussed in the report. Those items on the list which are not practical, have been previously accomplished, are inappropriate or can be eliminated from detailed analysis based on preliminary analysis shall be listed in the report along with the reason for elimination from further analysis. All potential ECOs which are not eliminated by preliminary considerations shall be thoroughly documented and evaluated as to technical and economic feasibility. The AE shall obtain all the necessary data to evaluate the ECOs by conducting a site survey. However, the AE is encouraged to use any data that may have been documented in a previous study. The AE shall document his site survey on forms developed for the survey, or standard forms, and submit these completed forms as part of the report. All test and/or measurement equipment shall be properly calibrated prior to its use.

7.5 Provide Programming or Implementation Documentation. For projects or ECOs reevaluated or developed during this study, complete programming or implementation documentation shall be prepared by the AE.

7.5.1 Programming Documentation. For projects or ECOs which meet ECIP criteria and which the installation wants to submit as an ECIP project, complete programming documentation shall be prepared. Complete programming documentation consists of DD Form 1391, Project Development Brochure (PDB) and supporting data. These forms shall be separate from the narrative report. They shall be bound similarly to the final report in a manner which will facilitate repeated disassembly and reassembly.

7.5.1.1 Military Construction Project Data (DD Form 1391). These documents shall be prepared in accordance with AR 415-15 and the supplemental requirements in Annex C. A complete DD Form 1391 shall be prepared for each project. The form shall include a statement that the project results from an EEAP study. Documents shall be complete as required for submission to higher DA headquarters. These programming documents will require review and signatures by the proper installation personnel. All documents shall be completed except for the required signatures.

7.5.1.2 Project Development Brochure (PDB). Preparation of the PDB requires the AE to delineate the functional requirements of the project as related to the specific site. The AE shall prepare PDBs in accordance with AR 415-20 and TM 5-800-3. Most projects will not require all4the forms and checklists included in the Technical Manual (TM). Only that information needed for the project shall be included. The PDB-I format described in the TM shall be used for whatever information is needed.

7.5.2 Implementation Documentation. For feasible projects or ECOs which normally do not meet ECIP criteria, implementation documentation shall be prepared. Each feasible project or ECO shall be individually packaged and fully documented and included as a separate section in the volume containing the programming documentation. Each project or ECO shall have a complete description of the changes required, economic justifications, sketches, and other backup data included as a section in the report. The documentation required will be as determined by the Government's representative. Documentation required will be in the categories listed in paragraph 5.2. For the QRIP, OSD PIF and FECIP projects, documentation shall be prepared in accordance with the requirements of AR 5-4, Change No. 1. A sample implementation document, consisting of a DA Form 5108-R, sketches and manufacturers data and a life cycle cost analysis summary sheet shall be submitted for review and approval. This sample shall be submitted with the interim submittal. This sample shall be approved before any other implementation documents are prepared. To the degree possible, the project or ECO selected for the sample submission shall be typical of the majority of subsequent projects to be submitted. The sample shall consist of complete implementation documents with primary emphasis on format and manner of presentation rather than precise accuracy of cost estimates and energy savings data. For MCA projects the documentation required shall be in accordance with paragraph 7.5.1 except that the economic analysis required by ETL 1110-3-332 shall be included in lieu of the ECIP life cycle cost analysis. For low cost/no cost projects which the Director of Engineering and Housing personnel can perform, the following information shall be provided:

a. Brief description of the project.

b. Brief description of the reasons for the modification.

c. Specific instructions for performing the modification.

d. Estimated dollar and energy savings per year.

e. Estimated manhours and labor and materials costs. Costs shall be calculated for the current calendar year and so marked. Manhours shall be listed by trade. For projects that would repair an existing system so that it will function properly, also include the estimated manhours by trade and labor and material costs necessary to maintain the system in that condition. Some of the simple practical modifications may be developed on a per unit basis. An example of this type of modification would be the repair or replacement of steam traps on an as needed basis. As a rule, however, the AE should develop complete projects, if at all possible, rather than per unit modifications. Separate sheets for each project showing the above information shall be prepared and included in the report.

7.6 Submittals, Presentations and Reviews. The work accomplished shall be fully documented by a comprehensive report. The report shall have a table of contents and be indexed. Tabs and dividers shall clearly and distinctly divide sections, subsections, and appendices. All pages shall be numbered. The AE shall give a formal presentation of all but the final submittal to installation, command, and other Government personnel. During the presen-

tation, the personnel in attendance shall be given ample opportunity to ask questions and discuss any changes deemed necessary to the study. A review conference will be conducted the same day, following the presentation. Each comment presented at the review conference will be discussed and resolved or action items assigned. The AE shall provide the comments from all reviewers and written notification of the action taken on each comment to all reviewing agencies within three weeks after the review meeting. It is anticipated that each presentation and review conferance will require approximately one working day. The presentation and review conferences will be at the installation on the date(s) agreeable to the Director of Engineering and Housing, the AE and the Government's representative. The Contracting Officer may require a resubmittal of any document(s), if such document(s) are not approved because they are determined by the Contracting Officer to be inadequate for the intended purpose.

7.6.1 Interim Submittal. An interim report shall be submitted for review after completion of the field survey and an analysis has been performed on all of the ECOs. The report shall indicate the work which has been accomplished to date, illustrate the methods and justifications of the approaches taken and contain a plan of the work remaining to complete the study. Calculations showing energy and dollar savings and SIRs of all the ECOs shall be included. The simple payback period of all ECOs shall be calculated and shown in the report. The AE shall submit the Scope of Work and any modifications to the Scope of Work as an appendix to the report. A narrative summary describing the work and results to date shall be a part of this submittal. During the review period, the Government's representative shall coordinate with the Director of Engineering and Housing and provide the AE with direction for packaging or combining ECOs for programming purposes and also indicate the fiscal year for which the programming or implementation documentation shall be prepared. A sample implementation document (DA Form 5108-R, sketches and manufacturers data, life cycle cost analysis summary sheet and supporting data) for one project shall be submitted with this submittal for review and approval. The survey forms completed during this audit shall be submitted with this report. The survey forms only may be submitted in final form with this submittal. They should be clearly marked at the time of submission that they are to be retained. They shall be bound in a standard three-ring binder which will allow repeated disassembly and reassembly of the material contained within.

7.6.2 Prefinal Submittal. The AE shall prepare and submit the prefinal report when all work under this contract is complete. The AE shall submit the Scope of Work for the installation studied and any modifications to the Scope of Work as an appendix to the submittal. The report shall contain a narrative summary of conclusions and recommendations, together with all raw and supporting data, methods used, and sources of information. The report shall integrate all aspects of the study. The report shall include an order of priority by SIR in which the recommended ECOs should be accomplished. The synergistic effects of all of the ECOs on one another shall have been determined and the results of the original calculations adjusted accordingly. Completed programming and implementation documents for all recommended projects shall be included. The programming and implementation documents shall be ready for review and signature by the installation commander. The prefinal

report, separately bound Executive Summary and all appendices shall be bound in standard three-ring binders which will allow repeated disassembly and reassembly. The prefinal submittal shall be arranged to include (a) a separately bound Executive Summary to give a brief overview of what was accomplished and the results of this study using graphs, tables and charts as much as possible (See Annex D for minimum requirements), (b) the narrative report containing a copy of the Executive Summary at the beginning of the volume and describing in detail what was accomplished and the results of this study, (c) appendices to include the detailed calculations and all backup material and (d) the programming and implementation documentation. A list of all projects and ECOs developed during this study shall be included in the Executive Summary and shall include the following data from the life cycle cost analysis summary sheet: the cost (construction plus SIOH), the annual energy savings (type and amount), the annual dollar savings, the SIR, the simple payback period and the analysis date. For all programmed projects also include the year in which it is programmed and the programmed year cost.

7.6.3 Final Submittal. Any revisions or corrections resulting from comments made during the review of the prefinal report or during the presentation and review conference shall be incorporated into the final report. These revisions or corrections may be in the form of replacement pages, which may be inserted in the prefinal report, or complete new volumes. Pen and ink changes or errata sheets will not be acceptable. If replacement pages are to be issued, it shall be clearly stated with the prefinal submittal that the submitted documents will be changed only to comply with the comments made during the prefinal conference and that the volumes issued at the time of the prefinal submittal should be retained. Failure to do so will require resubmission of complete volumes. If new volumes are submitted, they shall be in standard three-ring binders and shall contain all the information presented in the prefinal report with any necessary changes made. Detailed instructions of what to do with the replacement pages should be securely attached to the replacement pages.

ANNEX B

REQUIRED DD FORM 1391 DATA

To facilitate project approval, the following supplemental data shall be provided:

a. In title block clearly identify projects, e.g. ECIP, ORIP, etc.

b. Complete description of each item of work to be accomplished including quantity, square footage, etc.

c. A comprehensive list of buildings, zones or areas including building numbers, square foot floor area, designated temporary or permanent, and usage (administration, patient treatment, etc.)

d. List references, and assumptions, and provide calculations to support dollar and energy savings, and indicate any added costs.

e. Each project shall be keyed to identify maintenance and new work costs.

(1) If a specific building, zone, or area is used for sample calculations, identify building, zone or area, category, orientation, square footage floor area, window and wall area for each exposure.

(2) Identify weather data source.

(3) Identify infiltration assumptions before and after improvements.

(4) Include source of expertise and demonstrate savings claimed. Identify any special or critical environmental conditions such as pressure relationships, exhaust or outside air quantities, temperatures, humidity, etc.

f. Claims for boiler efficiency improvements must identify data to support present properly adjusted boiler operation and future expected efficiency. If full replacement of boilers is indicated, explain rejection of alternatives such as replace burners, nonfunctioning controls, etc. Assessment of the complete existing installation is required to make accurate determinations of required retrofit actions.

g. Lighting retrofit projects must identify number and type of fixtures, and wattage of each fixture being deleted and installed New lighting shall be only of the level to meet current criteria. Lamp changes in existing fixtures is not considered an ECIP type project.

ANNEX C

EXECUTIVE SUMMARY GUIDELINE

1. Introduction

2. Building Data (types, number of similar buildings, sizes, etc.)

3. Present Energy Consumption.

   a. Total Annual Energy Used.

   b. Source Energy Used.

      Electricty - KWH, Dollars, BTU

      Fuel Oil - GALS, Dollars, BTU

      Natural Gas - THERMS, Ddollars, BTU

      Propane - GALS, Ddollars, BTU

      Other - QTY, Dollars, BTU

4. Energy Conservation Analysis.

   . ECOs Investigated.

   . ECOs Recommended.

   . ECOs Rejected. (Provide economics or reasons)

   . ECIP Projects Developed. (Provide list)*

   . Non-ECIP Projects Developed. (Provide list)*

   . Operational or Policy Change Recommendations.

* Include the following data from the Life Cycle Cost Analysis Summary Sheet: the cost (construction plus SIOH), the annual energy savings (type and amount), the annual dollar savings, the SIR and the the analysis date. For all programmed projects also include the year in which it is programmed and the programmed year cost. Show the simple payback period for all ECOs.

5. Energy and Cost Savings.

   - Total Potential Energy and Cost Savings.
   - Percentage of Energy Conserved.
   - Energy Use and Cost Before and After the Energy Conservation Opportunities are Implemented.

6. Energy Plan.

   - Project Breakouts with Total Cost and SIR.
   - Schedule of Energy Conservation Project Implementation

ANNEX D

GOVERNMENT-FURNISHED DATA

1. The following data shall be furnished by the Government for use on this project:

(a) Energy Resource Management Plan. ✓

NOT IN SERVICE

(b) ~~ETLs 1110-3-254, Use of Electric Power for Comfort Space~~ Heating; 1110-3-282, Energy Conservation; and ~~1110-3-332~~, [redacted] ECONOMIC STUDIES

(c) Energy Conservation Investment Program (ECIP) Guidance, dated 25 April 1988; CEHSC-FU-P 15 June 89,

(d) TM 5-785, Engineering Weather Data, TM 5-800-2, General Criteria Preparation of Cost Estimates, ~~TM 5-800-3~~, Project Development Brochure.

(e) ~~AR 415-15~~, Military Construction Army (MCA) Program Development, AR 415-17, Cost Estimating for Military Programming; AR 415-20, Construction, Project Development and Desigh Approval; AR 415-28, Department of the Army Facility Classes and Construction Categories; AR 415-35, Construction, Minor Construction; AR 420-10, General Provisions, Organization, Functions, and Personnel; AR 11-27 Army Energy Program; and AR 5-4, Change No. 1, Department of the Army Productivity Improvement Program.

(f) The latest applicable Engineer Improvement Recommendation System (EIRS) bulletin, for purposes of cost estimation.

(h) An example of a correctly completed implementation document for a non-ECIP project.

APPENDIX B

FUEL RATES

SCHEDULE MS
FEDERAL GOVERNMENT INSTALLATIONS

I. APPLICABILITY

This schedule is applicable to any Federal Government installation contracting for 1500 kW or more of alternating current electricity. Such installation served under this schedule may change to service under the Company's Schedule No. 6 - Large General Service, and vice versa, effective with the meter reading date immediately preceding the receipt by the Company of the Government's written request for such change, if (1) the initial term of the applicable schedule has been satisfied; or (2) a change is made in the rate for service under either schedule. However, when an installation makes such change, the installation must remain on the then-selected schedule for at least one year after the change is made, regardless of changes in either rate schedule during such one-year period, other contract provisions to the contrary notwithstanding.

II. SERVICE AVAILABLE

The Company will supply the equipment necessary and will deliver to the Customer at a delivery point mutually satisfactory to the Customer and the Company, 60 hertz alternating current electricity of the phase and Company standard nominal voltage desired by the Customer at said delivery point, provided electricity of the phase and voltage desired by the Customer is available generally in the area in which electricity is desired.

III. 30-DAY RATE

A.	KW Demand Charge		
	First 1500 kW of Demand or Less		$19,354.64
	Additional kW of Demand	@	$ 12.54 per kW
B.	Plus rkVA Demand Charge		
	All rkVA of Demand	@	$ 0.15 per rkVA
C.	Plus Energy Charge		
	All kWh	@	$ 1.968¢ per kWh

(Continued)

SCHEDULE MS
FEDERAL GOVERNMENT INSTALLATIONS

(Continued)

III. 30-DAY RATE (Continued)

D. Annual Fuel Adjustment Factor

1. The kilowatthours in each customer's bill for the current billing month shall be multiplied by an annual fuel adjustment factor which shall be equal to the sum of:

(a) the estimated current-period fuel adjustment factor, and

(b) the prior-period deferral adjustment factor.

2. The estimated current-period fuel adjustment factor to become effective with the April billing month of each year shall be based on the total estimated system fuel expenses allocable to Schedule MS and Schedule MS kilowatthour sales for the 12-month period beginning in April of each year, and shall be calculated by the fuel adjustment factor formula shown below rounded to the nearest thousandth of a cent.

3. The prior-period deferral adjustment factor to become effective with the April billing month of each year shall be based on the difference between the total fuel expenses (using the criteria outlined (a) through (c) of paragraph 7. below) allocable to Schedule MS and the total fuel recoveries by Schedule MS customers for the 12 months prior to April of each year, divided by the estimated Schedule MS kilowatthour sales for the 12-month period beginning with April of each year (6 months where a semi-annual change is made pursuant to paragraph 5. below). The prior-period deferral adjustment factor will be adjusted for taxes.

(Continued)

SCHEDULE MS
FEDERAL GOVERNMENT INSTALLATIONS

(Continued)

III. 30-DAY RATE (Continued)

4. The intent of the annual fuel adjustment factor is to recover all fuel expenses allocable to Schedule MS customers. To the extent the amount recovered from Schedule MS customers through annual fuel adjustment factors and the fuel component of the base rate exceeds the cost of fuel allocable to Schedule MS for the same time period, this over-recovery shall be a credit in the calculation of the prior-period deferral adjustment factor for the 12-month period beginning with the next April. To the extent the amount recovered from Schedule MS customers through the annual fuel adjustment factor and the fuel component of the base rate is less than the cost of fuel allocable to Schedule MS for the same time period, this under-recovery shall be a charge in the calculation of the prior-period deferral adjustment factor for the 12-month period beginning with the next April.

5. The annual fuel adjustment factor shall be reviewed on a semi-annual basis to determine if any change is required. The current and prior period portions of the fuel adjustment factor will be reviewed individually, and a change to one or both may be made. The adjustment may be deferred until the end of the 12-month period, provided the net difference between the Company's actual and estimated under-recovery at the end of the 12-month period is no greater than seven and one-half per centum of actual and estimated fuel expenses or the net difference between the actual and estimated over-recovery at the end of the 12-month period is no greater than five per centum of actual and estimated fuel expenses.

(Continued)

SCHEDULE MS
FEDERAL GOVERNMENT INSTALLATIONS

(Continued)

III. 30-DAY RATE (Continued)

6. Fuel adjustment factor formula:

$$F = \left[\frac{E_1 + E_2}{S} - B \right] (T) \quad (100)$$

Where:

F = Estimated fuel adjustment factor in cents pe kilowatthour.

E_1 = Estimated North Anna fuel expenses plu estimated Old Dominion Electric Cooperativ Buyback fuel expenses allocated to Schedule M Customers.

E_2 = Estimated total fuel expenses less estimate North Anna fuel expenses and Old Dominic Electric Cooperative Buyback fuel expense allocated to Schedule MS Customers.

S = Estimated total Schedule MS kilowatthour sale for the 12-month period beginning with Apri each year.

B = Base cost of fuel per kWh = $0.01500.

T = Adjustment for state and local taxes measure by gross receipts: 100% divided by (100 minus applicable gross receipts tax rate).

(Continued)

Electric-Virginia

Superseding Schedule Adopted 05-17-91 Effective 03-16-91. This Schedule Adopted: 03-01-92. Effective: 03-01-92. Subject to approval of wholesale customer settlement ra in FERC Docket No. ER91-562-000.

SCHEDULE MS
FEDERAL GOVERNMENT INSTALLATIONS

(Continued)

III. 30-DAY RATE (Continued)

7. The estimated fuel expenses allocable to the Schedule MS Customers for the 12-month period beginning April of each year, shall be determined as follows:

(a) Fossil and nuclear fuel consumed in the Utility's own plants, and the Utility's share of fossil and nuclear fuel consumed in jointly owned or leased plants.

The cost of fossil fuels shall be those items initially charged to account 151 and cleared to accounts 501, 518, and 547 on the basis of fuel used. In those instances where a fuel stock account (151) is not maintained, e.g., gas for combustion turbines, the amount shall be based on the cost of fuel consumed and entered in account 547.

The cost of nuclear fuel shall be the amount contained in account 518 except that if account 518 also contains any expense for fossil fuel which has already been included in the cost of fossil fuel, it shall be deducted from this account.

Plus

(Continued)

SCHEDULE MS
FEDERAL GOVERNMENT INSTALLATIONS

(Continued)

III. 30-DAY RATE (Continued)

(b) The following purchased power costs:

(i) The fuel cost component of any purchased power transaction.

or

(ii) The total energy charges associated with economic purchases if the energy charges are less than the Company's total avoided variable costs during the purchase period.

or

(iii) The total expense associated with purchased power of less than twelve months duration if the total cost of the purchase is less than the Company's total avoided variable costs and if the purpose of the purchase was solely to displace higher cost generation. Purchases made to solely displace higher cost generation exclude reliability purchases. A purchase shall be deemed for reliability where the Company's system reserve criterion is not met. Such criterion is as follows:

Operating Reserve (consisting of the largest generating unit plus regulating margin plus load forecast margin)

Minus

75% of Emergency Contract Capacity

(Continued)

Electric-Virginia

Superseding Schedule Adopted 05-17-91 Effective 03-16-91. This Schedule Adopted: 03-01-92. Effective: 03-01-92. Subject to approval of wholesale customer settlement rate in FERC Docket No. ER91-562-000.

SCHEDULE MS
FEDERAL GOVERNMENT INSTALLATIONS

(Continued)

III. 30-DAY RATE (Continued)

Equals

Spinning Reserve Requirement

(iv) Energy receipts that do not involve money payments such as Diversity Energy and pay-back of Storage Energy are not defined as Purchased or Interchanged Power relative to the Fuel Clause.

Minus

(c) The cost of fossil and nuclear fuel recovered through inter-system sales including the fuel costs related to economy energy sales and other energy sold on an economic dispatch basis.

Energy deliveries that do not involve billing transactions such as Diversity Energy and pay-back of Storage Energy are not defined as sales relative to the Fuel Clause.

E. The charges in Paragraph III. above to Federal Government customers served under this schedule shall be increased or decreased appropriately by any applicable riders.

(Continued)

SCHEDULE MS
FEDERAL GOVERNMENT INSTALLATIONS

(Continued)

IV. DISCOUNTS

Discounts will apply only to charges under Paragraphs III.A. and C. for services with delivery voltages of 69 kV or higher.

A.	KW Demand Discount All KW of Demand	@ $0.66 per kW Discount
B.	Energy Charge Discount Energy Charge	@ 2.0% Discount

V. MINIMUM CHARGE

The minimum charge shall be such as may be contracted for but not less than the sum of the charges in the 30-Day Rate Paragraph III.A. and B. including applicable discounts in Paragraph IV.A. This includes no allowances of energy, and all energy used shall be paid for in addition at the above rates. Such minimum charge shall be increased in the amount of the applicable fuel adjustment under Paragraph III.D.

VI. OTHER PROVISIONS

A. Determination of kW Demand

The kW of demand billed under Paragraph III.A. shall be the highest of:

1. The highest average kW measured at this location in any 30-minute interval during the on-peak hours of 7:00 a.m. to 10:00 p.m., Mondays through Fridays, plus 30% of the excess of this amount determined in a similar manner during any other period during the current billing month, or

(Continued)

Superseding Schedule Adopted 05-17-91 Effective 03-16-91. This Schedule Adopted: 03-01-92. Effective: 03-01-92. Subject to approval of wholesale customer settlement ra in FERC Docket No. ER91-562-000.

SCHEDULE MS
FEDERAL GOVERNMENT INSTALLATIONS

(Continued)

VI. OTHER PROVISIONS (Continued)

2. 90% of the highest kW of demand at this location as determined by Subparagraph VI.A.1., above during the billing months of June through September of the preceding eleven billing months, or

3. 50% of the kW of demand contracted for under Paragraph VII., or

4. 1500 kW.

B. Determination of rkVA Demand

The rkVA of demand billed shall be the highest average rkVA measured in any 30-minute interval during the current billing month.

VI. OTHER PROVISIONS (Continued)

C. Meter Reading and Billing

When the actual number of days between meter readings is more or less than 30 days, the kW Demand Charge, the rkVA Demand Charge, the charge per kW of contracted demand in Paragraph VIII.C., and the minimum charge of the 30-day rate will each be multiplied by the actual number of days in the billing period and divided by 30.

D. Late Payment Charge

A late payment charge of one percent (1%) per month will be applied on all amounts that remain unpaid on the Company's books on the next billing date.

(Continued)

(Continued)

VII. DETERMINATION OF CONTRACT DEMAND

The contract demand under this schedule shall be the maximum number of kW which the Company is to supply. Contract demands may be changed by mutual agreement as to amount of change and term of agreement.

VIII. BREAKDOWN, RELAY OR PARALLEL OPERATION SERVICE

Breakdown, relay or parallel operation service may be contracted for under this schedule under the following conditions:

A. Suitable relays and protective apparatus shall be furnished, installed, and maintained at the Customer's expense in accordance with specifications furnished by the Company. The relays and protective equipment shall be subject, at all reasonable times, to inspection by the Company's authorized representative.

B. The contract demand to be billed under this Paragraph VIII. shall be the maximum number of kW which the Company is to supply. Contract demands may be changed by mutual agreement as to the amount of change and term of agreement. In case the maximum measured kW demand exceeds the contract demand, the measured demand becomes the contract demand for that month and for the next succeeding eleven month.

VIII. BREAKDOWN, RELAY OR PARALLEL OPERATION SERVICE (Continued)

C. When breakdown, relay or parallel operation service is furnished, the 30-Day Minimum Charge for electricity supplied under this schedule shall be not less than $12.54 per kW of demand contracted for under Paragraph VIII.B. plus any positive fuel adjustment charge under Paragraph III.D.

(Continued)

Superseding Schedule Adopted 05-17-91 Effective 03-16-91. This Schedule Adopted: 03-01-92. Effective: 03-01-92. Subject to approval of wholesale customer settlement rate in FERC Docket No. ER91-562-000.

SCHEDULE MS
FEDERAL GOVERNMENT INSTALLATIONS

(Continued)

IX. SCHEDULE TERMINATION, MODIFICATION OR REVISION

Whenever the Federal Energy Regulatory Commission shall permit a change in the rates set forth in the Company's Schedule NC-RS, Resale Service to the Town of Enfield, North Carolina and the Town of Windsor, North Carolina. (Schedule RS renamed in FERC Docket No. ER90-540-000) - to take effect, this rate schedule shall on the same effective date be modified so as to produce from the Federal Government customers served hereunder the same rate of return as the rates thus permitted to become effective for Schedule NC-RS customers, utilizing for that determination the same ratemaking methodology and test period as used in determining the NC-RS rates. Pending final decision by the FERC, the Federal Government would pay a rate as initially proposed by the Company after the suspension period, if any, subject to refund after final decision of any excess payments plus interest at the rate as authorized by the FERC. This method of determining a rate for the Federal Government customers will continue in effect indefinitely; provided, however, that either party may terminate this method of rate determination by giving six months' notice. Should such a termination occur, the parties, if appropriate, would negotiate a new rate in good faith.

X. TERM OF CONTRACT

The term of contract for the purchase of electricity under this schedule shall be such as may be mutually agreed upon, but for not less than one year.

(Continued)

RIDER OPEB
FOR SERVICE TO
FEDERAL GOVERNMENT INSTALLATIONS
UNDER SCHEDULE MS

For each billing month, the kW demand charge stated in Paragraph III.A. of Schedule MS shall be increased by $.07838/kW.

This Rider shall become effective on January 1, 1993, and is designed to recover costs associated with funding of Other Post Employment Benefits (OPEB) on an accrual basis in accordance with Financial Accounting Standard No. 106 (SFAS No. 106), "Employer's Accounting for Postretirement Benefits Other than Pensions," released December 1990, in excess of the amounts, calculated on a pay-as-you-go level, that are included in rates effective March 1, 1992. This Rider shall remain in effect until such time it is withdrawn or replaced by the Company.

FERC Filed:

Effective: March 1, 1992
Pending Acceptance by FERC

Docket No. ER91-562-000

SUMMER STEAM SHUTDOWN

The boilers in bldg. 447 operate year round. Until Oct. 31, 1990 they burned fuel oil. Since then we've used natural gas on an interruptible basis. Almost all fuel burned by the boiler plant during the last 2 years has been gas.

Fuel Costs and Consumption

An important factor in our determining the cost of producing heat are purchased fuel costs. What follows is a history of these costs over the last 3 years.

FY 90 Natural Gas=N/A Fuel Oil=$0.54/Gallon
FY 91 Natural Gas=$0.43/Therm
Fuel Oil=$0.99/Gallon
FY 92 Natural Gas=$0.35/Therm
Fuel Oil=$0.69/Gallon

Rates

These are the rates we charge our reimbursable customers such as the PX and Commissary for heat. They're based on total operating expenses for the boiler plant. (i.e.: fuel, labor and maintenance costs to both the plant and the distribution system, and miscellaneous expenses incurred). These rates aren't padded for administrative costs or to make a profit.

Ft. Myer: $1.63/square foot
Ft. McNair: $0.62/square foot
Cameron Station: $0.54/square foot

These costs have remained roughly the same over the past 3 years.

FUEL OIL COSTS

Revised 10-31-90

	FY 90			FY 91	
Cameron Station	Gallons	Cost	Total	Cost	Total
#5 oil	275,441 x	$0.54=	$148,738.14	$ .99=	$ 272,686.59
#2 oil	13,425 x	$0.56=	+ 7,518.00	$1.03=	+ 13,827.75
			$156,256.14		$ 286,514.34
		Projected cost increase of $130,258.20			
Ft. McNair					
#2 oil	7,255 x	$0.54=	$ 3,917.70	$1.03=	$ 7,472.65
#4 oil	41,531 x	$0.55=	+ 22,426.74	$ .99=	+ 41,115.68
			$ 26,344.44		$ 48,590.33
		Projected cost increase of $22,245.89.			

Ft. Myer

	FY 90		
#6 oil	1,398,753 gallons	x $0.52=	$ 727,351.04
#5 oil	72,426 gallons	x $0.54=	39,110.04
#2 oil	85,847 gallons	x $0.54=	+ 46,394.32
			$ 812,255.40
	FY 91		
#6 oil	279,750 gallons	x $0.99	$ 276,952.89
natural gas	1,674,026 therms	x $0.42	703,090.92
#5 oil	72,426 gallons	x $1.03	71,523.54
#2 oil	85,847 gallons	x $1.03	+ 85,332.41
			$1,136,899.70

The figures above are for total consumption. The impact on the Staff Engineer is shown below.

FY 90

Total fuel cost	$ 994,856.00
Natural gas	113,511.00
Reimbursed	- 299,792.00
Staff Engr. cost	$ 808,575.00

FY 91

Total fuel cost	$1,472,004.00
Reimbursed	- 329,772.00
Staff Engr. cost	$1,114,232.00

FY 91

P

~~G 1 21~~

$0.43/Th.

	Th.	$
Nov.	32,549.1	$14,125.11
Dec	195,467.4	84,050.98
Jan.	238,689.9	102,636.66
Feb	158,502.6	68,156.12
Mar.	201,671.0	86,718.57
Apr.	146,880.0	64,025.59
May	115,722.5	49,760.68
June	113,192.1	48,672.60
July	123,545.6	53,124.64
Aug.	107,610.0	38,421.48.
Sept.	+ 33,354.0	+ 11,628.12
	1,457,484.2	$621,320.55

FY 92

	Th	$
Oct	3978.0	$2051.80
Nov	172,788.0	61,236.50
Dec.	217,250.8	74,289.53
Jan.	186,090.4	64,513.00
Feb.	229,600.8	80,381.28
Mar.	197,074.6	68,976.11
Apr.	89,278.6	31,247.51
May	103,935.0	36,377.25
June	75,412.5	27,444.38
July	59,640.9	20,874.32
Aug.	59,54.5	20,14.90

Th.	$
1,403,901	$487,80

CENTRAL STEAM PLANT
FORT MYER
FY 91 STEAM COSTS

PLANT INPUT

Gas consumed, therms:	1,328,537
BTUs/therm:	100,000
Total BTUs, gas:	1.33E+11
#6 oil consumed, gal:	234,454
BTUs/gal:	145,000
Total BTUs oil:	3.40E+10
TOTAL PLANT INPUT, BTUs	1.67E+11
Plant efficiency:	0.82
TOTAL PLANT OUTPUT, BTUs:	1.37E+11
Plant operating pressure:	100 psi
Enthalpy, Hfg (BTUs/lb):	888.2
TOTAL PLANT OUTPUT, LBS:	1.54E+08

$\frac{1.33ee11}{1.67ee11} = 79.6\%$ of total plant input

$\frac{3.40ee10}{1.67ee11} = 20.4\%$ of total plant input

OPERATING COSTS

Fuel gas cost:	571,271
Fuel oil cost:	236,823
Plant electric cost:	0
Plant water/sewage cost:	0
Plant M&R cost:	64,823
Plant operations cost:	897,341
Distribution M&R cost:	356,062
TOTAL OPERATING COST:	$2,126,320
TOTAL COST PER LB. STEAM:	$ 0.0138
TOTAL COST PER KILO-LB:	$13.80

2.41/1000gal

billed for 92% of actual sewer discharge

Bldg. is not metered
estimate of electric
from Bob Hennessee (11/24)
(rough) based on Base wide $
= $9,915 BLDG. 447

We're on interruptible service.

Fuel oil rates: '89 = $.54/Gallon
90 = .99/"
91 = .69/"

Gas Aug 90 -- July 91 $.43/therm
August 91 -- July 92 = $.35/Therm
Aug 92 -- July 93 .31/Therm

The forecast is for slightly higher gas costs.

Plant costs for recent years:
~~Calendar Oct 31, 1990~~

FY91 1,467,842 Therms
$621,320.55

FY92 1,544,868.1 Therms $537,556.21
Oct. 31, 1990 Switched to gas.

FY 92 (Oct. 91 -- Sept. 92)

Ft. Meyer's Utility Consumption

Electricity $1,532,879.00
32,788,800 KWH

Natural Gas: TOTALS=$91,808.00
1,742,945.8 Therms

Family Housing $32,277.00
129,662.2 Therms

Postwide $558,817.00
1,612,481.5 Therms

Bldg 313 (Large Boilers)
$714.00
802.1 Therms

Bldg 447 (Central Heating Plant)
$558,817.00
1612481.5 Therms

Per Bob Hennessey 696-3811

434 # 77957 9-18-91

Oct.

WASHINGTON GAS INVOICES
FT. MYER POST
FY 92

CCF x 1.017 =Therms

Bldg.	Therms	Late Fees	Amount Due
Kennel	79.3		57.37
~~45A~~ 216	1.0		17.01
46A			
48	174.4		87.83
T49	141.4		107.84
50	255.4		142.19
T52	224.8		126.67
55	24.4		29.07
59	45.8		32.00
201	8.1		20.67
203	311.2		166.27
206	62.0		48.45
207	0		16.50
214	2769.3		1200.18
215	33.4		10.00
217	6.1		11.54
225	31.5		32.72
227	2377.7		295.03
229	24.1		27.53
230	119.0		77.82
231	115.9		76.22
232	59.0		46.90
234	47.8		41.13
236	38.6		36.39
237	46.8		32.51
238	77.3		56.23
239	73.2		54.22
241	125.1		72.87
242	91.5		55.55
245	10.2		13.66
305	19.3		18.34
309	18.3		12.70
313	761.1		456.09
318	10.2		21.76
322	1.0		17.01
323	99.2		204.96
335	11.2		22.27
404	807.5		385.67
412	33.6		33.02
420	1.0		21.76
423	43.2		15.20
434			
447			
468	280.7		153.29
469	39.3		36.96
Totals		10107.6	3441.51

CK: 1-30-92

10-17--11-19-91

Nov.

WASHINGTON GAS INVOICES
FT. MYER POST
FY 92

CCF x 1.019=Th

Bldg.	Therms	Late Fees	Amount Due
Kennel	167.1		100.32
45A			
46A			
48	118.2		73.99
T49	658.3		317.28
50	905.9		430.78
T52	687.8		338.90
55	58.1		46.44
59	79.5		49.37
201	468.7		238.47
203	785.6		383.74
206	274.1		149.27
207	1985.0		881.83
214	✓ 2754		1194.13
215	53		10.00
216	417.8		215.14
217	7.1		12.06
225	17.3		25.41
227	3176.2		1365.34
229	33.6		23.82
230	609.4		302.96
231	1439.8		660.54
232	197.7		114.24
234	133.5		84.82
236	84.6		60.09
237	123.3		71.94
238	96.8		66.38
239	91.7		63.75
241			
242	68.3		43.59
245	18.3		17.83
305	29.6		23.65
309	42.8		33.37
313	979.3		464.43
318	18.3		25.93
322	0		16.50
323	1753.7		787.94
335	625.7		310.44
404	921		437.79
411	449	4.72	606.12
412	59.1		46.95
420	11.2		22.27
423	72		19.94
434			
447			
468	1085.2		516.60
469	47		38.04
Totals	20,423.8		$ 10,707.40

long Cable

CR 241 $552.20

Dec.

WASHINGTON GAS INVOICES
FT. MYER POST
FY 92

11-19--12-18-91

CCF x 1.02=Th

Bldg.	Therms	~~Late Fees~~ Acct	Amount Due
Kennel	276.4	3500.140201	165.95
45A			
46A			
48	178.5	" .164003	110.94
T49	470.2	" .152008	259.12
50	936.4	.155001	498.66
T52	622.2	.151000	345.16
55	107.1	.148006	77.81
59	50.0	.125012	37.31
201	490.6	.165000	276.86
203	1,419.8	.167501	731.43
206	282.5	.092006	169.56
207	2404.1	.092501	1,188.06
214	~~2735.6~~	.070515	~~1,343.29~~
215	~~3~~	.070002	~~10.26~~
216	622.2	.078203	341.77
217	7.1	.068006	12.55
225	68.3	.059005	55.57
227	2 709.1	.061019	1,333.11
229	94.4	.062009	70.77
230	544.7	.063007	305.17
231	509.0	.065002	290.59
232	263.2	.066000	159.36
234	160.1	.067008	106.32
236	66.3	.074509	54.78
237	57.1	.075001	41.57
238	86.7	.076017	66.43
239	240.7	.077007	147.34
241	——	.078005	—— *
242	88.7	.118009	59.24
245	15.3	.080001	17.27
305	24.5	.051002	22.56
309	28.6	.050004	27.39
313	1,562.6	.057009	789.66
318	12.2	.054006	23.69
322	4.1	.056506	19.00
323	1,706.5	.100205	859.15
335	543.7	.134006	304.74
404	817.0	.035013	437.66
411	262.1 ✓	.057108	15.40 ✓
412	152.0	.091008	101.81
420	12.2	.093004	22.65
423	17.3	.094002	18.42
434	——	.100007	—— *
447			
468	856.8	098508	466.71
469	38.8	.099027	38.43
Totals	21,548.3		# 11,567.14

CREDITS

241 $ 459.47

434 # 13T.08
241 327.37

Jar

WASHINGTON GAS INVOICES
FT. MYER POST
FY 92

12-18-91 -- 1-23-92

CCF x 1.018 =Th

Bldg.	Therms	Late Fees	Amount Due
Kennel			
45A			
46A			
48	183.2	1.11	112.50
T49	1427.2	2.61	718.85
50	1747.9	5.00	866.91
T52	1507.7	3.47	764.38
55	94.7	.78	70.65
59	113.0	.38	72.46
201	975.2	2.78	520.52
203	3187.4	7.34	1531.17
206	778.8	1.70	419.93
207	4059.8	11.92	1431.99
214	~~2986~~	13.49	~~1446.20~~
215	~~98~~	.10	~~10.25~~
216	1060.8		557.92
217	9.2	.12	13.71
225	149.6	.55	99.96
227	5124.6	13.39	2417.09
229	135.4	.71	92.93
230	2243.7	3.07	1098.27
231	1062.8	2.94	561.78
232	475.4	1.60	266.10
234	292.2	1.06	172.73
236	45.8	.55	42.87
237	124.2	.42	78.82
238	1069	.67	77.42
239	382.8	1.48	219.06
241			*
242	774	.60	52.62
245	12.2	.17	15.45
305	32.6	.22	27.06
309	34.6	.27	30.47
313	2467.6	7.92	1196.71
318	19.3	.23	27.60
322	1.0		33.74
323	2977.7	75.21	1428.58
335	1233.8	3.07	639.57
401	~~895.8~~	4.40	~~473.84~~
411	~~396.0~~	1.62	217.78
412	438.8	1.02	246.97
420	15.3	.23	25.36
423	~~30.5~~	.18	25.77
434			*
447			
468	1373.3	4.70	704.57
469	~~75.3~~	.40	59.34
Totals	38,359.4		$ 19,369.81

CREDITS

241 $ 209.71
322 0.19
434 717.05

28 Days 1-23--2-24-92

February

WASHINGTON GAS INVOICES
FT. MYER POST
FY 92

CCF x 1.018=Th

Bldg.	Therms	Late Fees	Amount Due
Kennel		3500.140201	
~~45A~~			
~~46A~~			
48	207.7		123.96
T49	853.1		447.78
50	1494.4		746.76
T52	1083.2		568.10
55	163.9		106.66
59	60.1		42.27
201	888.7		473.51
203	2495.1		1209.39
206	496.8		275.34
207	3591.5		1707.37
~~214~~	2913.5 ✓		$1,394.43 ✓
215	3 ✓		10.15 ✓
216	878.5		468.75
217	9.2		13.59
225	123.2		85.94
227	2555.2		1236.68
229	167.0		108.23
230	956.9		508.47
231	890.8		474.98
232	411.3		232.02
234	266.7		158.75
236	81.4		62.38
237	76.4		51.46
238	95.7		70.43
239	396.0		224.26
241			*
242	92.6		60.59
245	18.3		18.71
305	30.5		25.59
309	46.6		31.30
~~313~~	2215.2		1074.55
318	15.3		25.13
322			*
323	2807.6		1351.32
335	1080.1		566.69
404	884.6		463.74
411	301.3 ✓		468.18 ✓
412	266.7		158.75
420	14.3		24.56
423	23.4 ✓		21.59 ✓
434		3500.100007	*
~~447~~			
468	1347.8 ✓		688.28 ✓
469	158.8		104.07
Totals	30230.3		$15,589.71

468 cr per Ms. Hess phone call 4-9-92

241 $307.35
434 703.18
~~469~~ 22.21

March

WASHINGTON GAS INVOICES
FT. MYER POST
FY 92

CCF x 1.018 = Th

Bldg.	Therms	Late Fees	Amount Due
Kennel	408.6	6.91	755.09
45A			
46A			
48	153.9		84.73
T49	1075.0		475.00
50	1073.0		474.25
T52	1034.3		467.70
55	115.1		72.67
59	92.7		53.64
201	683.7		318.35
203	2184.7		903.24
206	765.3		353.54
207	2615.8		1066.45
214	[illegible]		✓ 1027.49
215	[illegible]		/ 9.37
216	684.8		318.83
217	6.1		11.38
225	89.7		60.27
227	2791.0		2369.46
229	74.4		52.81
230	1849.5		776.33
231	368.9		182.65
232	530.9		252.48
234	203.8		111.47
236	90.7		60.76
237	97.8		56.13
238	101.9		66.22
239	284.3		146.18
241	—	—	— *
242	80.5		47.69
245	4.1		10.40
305	22.4		19.33
309	31.6		26.15
313	?	— ? —	— ? —
318	17.3		24.94
322	2.0		15.05
323	2183.7		902.86
335	795.8		366.62
404	[illegible]		377.56
411	[illegible]		1,495.00
412	410.7		202.66
420	13.2		22.94
423	[illegible]		25.82 ✓
434	—		— *
~~447~~			
468	—	—	— *
469	[illegible]		[illegible]
Totals	24,511.6	24,055	#12,661.52

0919

271
434
225

69.43
2439

3-24-

Apr. 1

WASHINGTON GAS INVOICES
FT. MYER POST
FY 92

CCF x 1.017=Th

Bldg.	~~Therms~~	~~Late Fees~~ Therms	Amount Due
Kennel		194.2	10418
45A			
46A			
48		164.8	87.68
T49		495.3	325.76
50		797.3	451.05
T52		526.4	302.46
55		71.3	[illegible]
59		506	371.[illegible]
201		323.6	
203		1119.7	493.92
206		222.7	19.55
207		1[illegible]	[illegible]
214		1944.2	1125.[illegible]
215		31	4.[illegible]
216		1[illegible]7	1[illegible]
217		71	11.96
225		54.9	23.00
227			
229	~	7[illegible]	52.[illegible]
230		1294.2	304.45
231		1414	326.52
232		412.6	114.95
234		127.1	72.45
236		52.9	32.07
237		65.1	39.67
238		76.3	53.16
239		180.0	94.75
241			
242		77.3	45.35
245		12.2	14.24
305		23.4	14.63
309		23.4	21.55
313		1[illegible]5.1	176.44
318		12.2	2[illegible]
322		1.0	17.12
323		1329.2	657.52
335		573.2	193.12
404		792.2	347.97
411		276.0	131.22
412		120.0	75.12
420		11.2	22.72
423		19.2	17.76
434			
447			
468		2756.3	721.15
469		451.9	48.78
Totals		17,500.4	11,751.44

May

WASHINGTON GAS INVOICES
FT. MYER POST
FY 92

4-22 — 5-21-92

CCF x 1.023 = Th

Bldg.	Therms	Late Fees	Amount Due
Kennel	140.2		82.82
45A			
46A			
48	123.8		70.40
T49	371.3		171.84
50	423.5		194.75
T52	382.6		179.08
55	1.0		17.51
59	72.6		42.23
201	11.3		22.52
203	926.8		413.10
206	246.5		127.09
207	370.3		183.04
214	3,262.3		1269.77 ✓
215	4.1		10.44 ✓
216	180.0		98.29
217	6.1		11.40
225	22.5		27.55
227	6,873.5		2542.67
229	193.3		103.81
230	471.6		221.42
231	185.2		102.55
232	125.8		76.97
234	90.0		59.74
236	68.5		49.24
237	75.7		44.52
238	97.2		62.90
239	29.7		31.51
241			*
242	70.6		42.17
245	0		8.54
305	39.9		27.42
309	0		14.26
313	567.8		253.86
318	11.3		22.05
322	1.0		17.14
323	1107.7		506.70
335	121.7		75.76
404	[illegible]		424.78
411	[illegible]		107.24 ✓
412	110.5		69.40
420	12.3		22.52
423	[illegible]		18.78 ✓
434			*
447			
468	466.5		224.37 ✓
469	[illegible]		46.15
Totals	18,545.5		$ 8,459.95

CREDITS

241 $213.10
434 724.07

June

WASHINGTON GAS INVOICES
FT. MYER POST
FY 92

CCF x 1.036=Th

Bldg.	Therms	Late Fees CCF's	Amount Due
Kennel	31.8		31.66
45A			
46A			
48	164.2		87.39
T49	175.2		89.16
50	350.4		162.85
T52	174.4		102.90
55	15.4		23.85
59	61.6		37.77
201	41.2		20.41
203	135.2		80.47
206	35.4		22.62
207	1.2		16.98
214	7192.3		2718.56 ✓
215	3.1		4.88 ✓
216	179.4		19.81
217	6.2		11.36
225	7.2		19.93
227	6886.0		98.56
229	9.2		21.42
230	52.3		41.44
231	158.6		47.96
232	38.0		34.61
234	31.8		31.66
236	38.0		34.61
237	60.5		37.24
238	71.8		50.73
239	30.8		31.18
241	—		— *
242	78.0		45.59
245	10.3		13.31
305	22.6		19.18
309	—		— *
313	922.4		402.82
318	10.3		21.41
322	0		16.50
323	322.2		107.78
335	12.3		22.36
404	8866.5		387.76
411	3089		145.63 ✓
412	14.4		23.36
420	11.3		21.39
423	14.4		15.26 ✓
434	—		— *
447			
468	242.1		125.27 ✓
469	62.6		46.35
Totals	18,838.1	18,361	#5,351.98

* Credits

Bldg. 241 — #150.87

309 — 8.37

159.24

Jul

WASHINGTON GAS INVOICES
FT. MYER POST
FY 92 6-22--7-22-92

CCF x 1.024=Th

Bldg.	Therms	Late ~~Fees~~ CCFS	Amount Due
Kennel			
45A			
46A			
48	59.4		39.57
T49	103.4		57.71
50	234.5		113.99
T52	14.2		23.31
55	12.3		22.36
59	56.3		35.25
201	2.2		10.41
203	—		— *
206	—		— *
207	1.0		16.98
214	6758.4		2559.15 ✓
215	3.1		9.18 ✓
216	1.0		16.99
217	5.1		10.23
225	18.4		11.19
227	0		16.56
229	—		— *
230	6.1		19.41
231	—		— *
232	16.4		6.21
234	19.5		25.79
236	27.6		24.66
237	76.8		45.02
238	81.9		55.55
239	20.5		26.27
241	—		— *
242	19.5		17.69
245	2.0		9.35
305	39.9		27.43
309	—		— *
313	774.1		340.55
318	11.3		21.71
322	3.1		17.98
323	—		— *
335	—		— *
405	[illegible]		365.96
412	0		0
412	4.7		11.60
420	12.3		22.36
423	[illegible]		18.57 ✓
434	—		— *
447			
468	140.3		52.53 ✓
[illegible]	[illegible]		[illegible]
Totals	9453.5	9232	# 4146.73

CREDITS

Bldg		
Bldg 203	$ 21.58	
" 206	0.62	
	75.29	

Bldg.	#
231	# 25.68
241	1+5.21

Bldg.	#
323	# 232.60
335	27.82

Aug

WASHINGTON GAS INVOICES
FT. MYER POST
FY 92

CCF x 1.021 = Th

Bldg.	Therms	Late Fees	Amount Due
Kennel	19.4		70.54
45A			
46A			
48	125.6		70.96
T49	122.5		56.81
50	245.2		123.25
T52	100.1		64.23
55	5.1		18.93
59	54.1		34.19
201	8.2		20.41
203	—		— *
206	0		15.88
207	0		16.50
214	7388.0		2790.46 ✓
215	3.1		9.88
216	0.0		16.02
217	5.1		10.83
225	0		16.50
227	0		16.50
229	0		— *
230	0		16.50
231	34.7		7.37
232	9.2		20.89
234	16.3		24.27
236	17.6		29.66
237	57.2		35.68
238	65.3		47.63
239	9.2		20.89
241	—		— *
242	60.2		37.10
245	7.1		11.78
305	22.5		19.13
309	—		— *
313	737.2		325.06
318	9.2		20.89
322	0		16.50
323	—		— *
335	—		— *
402	796		349.92
411			
412	0		16.50
420	10.2		21.37
423	13.3		14.74 ✓
434	—		— *
447			
468	142.9		83.61
469	92.9		60.80
Totals	10,187.8		#4541.18

* Credits

203	#5.08	309	#.85
229	61.79	323	540.38
		335	4.99

Sept.

WASHINGTON GAS INVOICES
FT. MYER POST
FY 92

8-20-92--9-21-92
CCF x 1.025=Th

Bldg.	Therms	Late Fees	Amount Due
Kennel	57.4		48.64
~~452~~			
~~463~~			
48	56.4		42.64
T49	140.4		84.46
50	260.4		143.40
T52	69.6		4.55
55	19.5		27.18
59	32.8		26.38
201	8.2		20.99
203	53.3		40.63
206	0		16.50
207	0		16.50
214	8187.7		✓ 3667.23
215	3.1		✓ 10.10
216	1.0		17.05
217	6.2		11.80
225	24.6		29.98
227	512.5		275.30
229	—		— *
230	30.8		33.38
231	9.2		21.55
232	9.2		21.55
234	21.5		28.29
236	32.8		34.48
237	77.9		51.07
238	83.0		61.98
239	39.0		37.88
241	—		— *
242	36.9		28.62
245	5.1		11.20
305	25.4		28.07
309	0		6.15
313	578.1		299.[illegible]
318	10.3		22.15
322	3.1		18.20
323	—		— *
335	15.4		17.96
~~400~~	~~[illegible]~~		~~396.07~~
~~4[illegible]~~	~~29[illegible]~~		✓ 430.04
412	1		17.05
420	16.4		25.49
~~42[illegible]~~	~~[illegible]~~		✓ ~~19.08~~
434	—		— *
447			
468	126.1		✓ 55.54
~~46[illegible]~~	~~8[illegible]~~		~~20.99~~
Totals	11,660.6		# 6,201.56

*CR
229 $45.29
241 81.53

434 $542.92

Oct

WASHINGTON GAS INVOICES
FT. MYER FAMILY HOUSING
FY 92

CCF x 1,017 Therms

Bldg.	Therms	Late Charges	Amount Due
1	164.8		99.16
2	119.0		72.17
5	87.5		57.97
6A	208.5		115.45
7	118.0		73.89
8	40.7		31.27
11B	51.9		35.13
12A	83.4		55.84
13A	36.6		29.14
14A	57.0		39.90
15A	59.0		40.55
16A	57.0		39.80
17	45.2		35.50
19A	69.2		46.17
20A	67.1		46.06
21A	46.2		34.47
22A	54.9		38.70
23A	67.1		45.07
24A	52.9		37.66
25A	87.5		61.60
26A	88.5		56.25
27A	61.0		41.89
28A	44.7		15.47
317B	45.8		34.91
426A	103.7		64.17
427A	49.8		35.97
428A	168.8	.04 arrs. late	96.40
431A	43.7		32.35
432A	248.1	.05 " "	134.54
435A	37.6		29.36
436A	107.8		68.47
439A	73.2		50.50
501	433.7		225.[illegible]
Totals	3083.6		$1922.21

Nov. 91

WASHINGTON GAS INVOICES
FT. MYER FAMILY HOUSING
FY 92

CCF x 1.019 Therms

Bldg.	Therms	Late Charges	Amount Due
1	773.4		378.14
2	335.3		176.41
5	325.1		173.76
6A	807.0		403.20
7	482.0		229.72
8	55.0		38.75
11B	64.2		44.55
12A	127.4		78.70
13A	32.6		27.05
14A	24.5		22.74
15A	61.1		41.13
16A	82.5		53.10
17	3.1		8.11
19A	95.8		60.05
20A	80.5		53.06
21A	54.0		38.22
22A	65.2		44.07
23A	90.7		57.39
24A	69.3		46.21
25A	111.1		73.75
26A	127.4		76.45
27A	75.4		49.40
28A	44.8		33.41
317B	86.6		56.24
426A	346.5		181.79
427A	52.0		37.17
428A	169.2		96.55
431A	43.8		32.90
432A	248.6		134.72
435A	37.7		29.71
436A	230.3		128.18
439A	257.8		141.39
501	476.9		243.75
Totals	5,936.8		$ 3290.57

December

WASHINGTON GAS INVOICES
FT. MYER FAMILY HOUSING
FY 92

11-19 to 12-18-91

CCF x 1.02 Therms

Bldg.	Therms	Acct. # ~~Late Charges~~	Amount Due
1	550.8	3500.156017	360.18
2	435.5	.157007	243.22
5	320.3	.154004	185.60
6A	868.0	.153006	470.21
7	445.7	.150002	251.32
8	66.3	.149004	47.60
11B	57.2	.147009	44.22
12A	91.8	.145002	64.57
13A	47.9	.143007	37.16
14A	66.3	.142009	47.44
15A	67.3	.141001	48.19
16A	73.4	.140003	51.72
17	58.1	.139005	42.70
19A	77.5	.138007	54.10
20A	94.9	.137009	64.83
21A	64.3	.136001	46.50
22A	74.5	.135003	52.29
23A	91.8	.119007	62.14
24A	57.1	.120005	42.51
25A	107.1	.121003	78.09
26A	155.0	.122001	96.56
27A	91.8	.123009	62.06
28A	51.0	.124007	38.99
317B	63.2	.053008	47.03
426A	318.2	.107002	182.34
427A	39.8	.106004	32.72
428A	192.8	.105006	116.42
431A	52.0	.104009	39.55
432A	283.6	.103001	164.02
435A	42.8	.102003	34.36
436A	295.8	.101005	172.55
439A	344.8	.098003	198.16
501	480.4	.040011	260.42
Totals	6236.9		3,744.77

Jan

WASHINGTON GAS INVOICES
FT. MYER FAMILY HOUSING
FY 92

12-18-91 -- 1-23-92

CCF x 1.018 Therms

Bldg.	Therms	Late Charges	Amount Due
1	1665.4	3.62	836.16
2	711.6	2.44	382.55
5	662.7	1.87	359.15
6A	1456.8	4.72	766.97
7	917.2	2.52	490.31
8	73.3	.48	51.12
11B	138.4	.50	87.67
12A	135.4	.65	87.53
13A	89.6	.37	60.04
14A	57.0	.47	42.09
15A	77.4	.49	53.41
16A	138.4	.52	86.49
17	26.5	.43	25.13
19A	103.8	.55	68.10
20A	87.5	.65	60.17
21A	83.5	.47	56.77
22A	81.4	.53	55.66
23A	104.9	.63	68.79
24A	100.8	.43	66.31
25A	155.8	.78	103.33
26A	221.9	.97	129.96
27A	99.8	.63	65.96
28A	10.2	.39	13.69
317B	116.1	.47	75.84
426A	611.8	1.84	330.77
427A	54.0	.33	40.28
428A	143.5	1.16	89.94
431A	57.0	.39	42.01
432A			*
435A	46.8	.34	36.30
436A	459.1	1.73	254.60
439A	872.4	1.99	466.81
501	576.2	2.62	302.53
Totals	10136.2	35.98	$5,656.64

CREDITS *

432A 637.06

February

WASHINGTON GAS INVOICES
FT. MYER FAMILY HOUSING
FY 92

1-23-92 -- 2-24-92

CCF x 1.018 Therms

Bldg.	Therms	Late Charges	Amount Due
1	1193.1	Acct.#	$ 618.01
2	719.7		384.26
5	569.1		309.28
6A	1328.5		696.45
7	761.5		407.95
8	66.2		46.71
11B	93.7		62.96
12A	107.9		72.07
13A	66.2		46.71
14A	77.4		52.92
15A	79.4		54.03
16A	98.7		64.72
17	62.1		44.44
19A	91.6		60.79
20A	101.8		67.44
21A	57.0		41.62
22A	71.3	3500-135903	43.68
23A	86.5	" .119007	57.96
24A	76.4		52.36
25A	128.3		88.62
26A	187.3		111.25
27A	88.6		59.12
28A	35.6		29.75
317B	87.5		59.52
426A	122.2		77.74
427A	50.9		38.23
428A	71.4		55.13
431A	49.9		37.68
432A			*
435A	41.7		33.14
436A	419.4		232.52
439A	533.4		290.97
501	557.9 ✓		291.00 ✓
Totals	7,092.2		$ 4609.03

CREDITS

432A #770.17

March

WASHINGTON GAS INVOICES
FT. MYER FAMILY HOUSING
FY 92

CCF x 1.019 Therms

Bldg.	Therms	Late Charges	Amount Due
1	1050.6		473.87
2	499.3		233.49
5	443.3		211.26
6A	736.7		337.29
7	620.6		288.77
8	56.0		36.82
11B	99.9		58.83
12A	131.5		74.94
13A	68.3		42.71
14A	6.1		9.90
15A	46.9		32.47
16A	83.6		50.04
17	53.0		35.39
19A	80.5		48.55
20A	86.6		52.47
21A	51.0		34.43
22A	65.2		41.23
23A	20.4		25.86
24A	54.0		35.87
25A	113.1		71.69
26A	151.8		81.56
27A			*
28A	32.6		25.62
317B	85.6		51.99
426A	111.1		63.19
427A	48.9		33.42
428A	544.1		253.63
431A	186.5		96.74
432A			
435A	37.7		28.06
436A	320.0		157.35
439A	399.4		192.06
~~502~~	~~359.8~~		✓ 126.39
Totals	6,544.1		$3,305.89 ✓

* Credits

27A #3.21
432A 493.00

A.

WASHINGTON GAS INVOICES
FT. MYER FAMILY HOUSING
FY 92

CCF x 1.017 Therms

Bldg.	Therms	Late Charges	Amount Due
1	601.0		277.70
2	331.5		157.09
5	342.7		163.84
6A	601.6		273.73
7	375.3		178.34
8	[illegible]		35.78
11B	[illegible]		43.11
12A	[illegible]		[illegible]
13A	[illegible]		32.09
14A	[illegible]		[illegible]
15A	[illegible]		39.01
16A	74.2		44.83
17	[illegible]		31.55
19A	[illegible]		[illegible]
20A	78.3		47.74
21A	50.9		[illegible]
22A	66.1		41.00
23A	65.1		[illegible]
24A	61.0		[illegible]
25A	98.6		63.74
26A	121.0		66.79
27A	61.0		35.02
28A	32.5		25.31
317B	61.0		39.75
426A	110.9		61.93
427A	41.7		29.64
428A	92.7		49.49
431A	64.1		40.64
432A	~~[illegible]~~		—
435A	37.6		27.68
436A	219.7 ~~[illegible]~~		111.52
439A	258.3		128.11
501	4321		187.48
Totals	4770.4	4852 ccfs	2451.03

Crs.

432A. # 446.31

WASHINGTON GAS INVOICES
FT. MYER FAMILY HOUSING
FY 92

Nov

4-22-- 5-21-92

CCF x 1.023 Therms

Bldg.	Therms	Late Charges	Amount Due
1	101.3		67.09
2	204.6		102.97
5	142.2		78.96
6A	378.5		177.30
7	265.0		130.80
8	62.4		39.24
11B	84.9		50.72
12A	26.6		25.14
13A	56.3		36.38
14A	29.7		24.09
15A	35.8		26.97
16A	89.0		51.62
17	44.9		40.35
19A	71.6		43.60
20A	68.5		43.18
21A	49.1		32.09
22A	63.4		39.75
23A	65.5		22.48
24A	46.0		31.69
25A	79.8		54.79
26A	93.1		53.74
27A	61.4		38.77
28A	45.0		31.08
317B	79.8		48.32
426A	111.5		62.27
427A	39.9		28.75
428A	206.6		267.90
431A	64.4		40.21
432A			
435A	37.9		27.81 *
436A	239.4		119.35
439A	126.9		72.17
~~507~~	~~534.5~~		153 ~~.54~~
Totals	3405.5	3329 CCFs	# 2,063.99

* Credits

Bldg.	Amount
432A	* 399.39

WASHINGTON GAS INVOICES
FT. MYER FAMILY HOUSING
FY 92

June

5-21--6-22-92

CCF x .026 Therms

Bldg.	Therms	Late Charges	Amount Due
1	80.0		54.65
2	75.91		45.50
5	33.9		28.11
6A	168.3		86.89
7	103.6		60.69
8	52.3		34.46
11B	57.5		37.90
12A	90.3		54.48
13A	36.9		27.27
14A	50.3		33.53
15A	60.5		38.30
16A	68.7		42.13
17	—		— *
19A	75.9		45.50
20A	68.4		43.65
21A	119.0		65.64
22A	73.9		44.56
23A	72.8		36.02
24A	67.7		41.67
25A	92.3		60.51
26A	86.2		50.32
27A	67.7		41.67
28A	26.7		22.50
317B	50.3		34.53
426A	123.1		67.55
427A	42.1		29.70
428A	228.8		112.66
431A	70.8		43.11
432A	—		— *
435A	42.1		29.70
436A	87.2		53.03
439A	68.7		44.38
501	437.2		174.32
Totals	2779.5	2709	$1,604.93

* Cr.

Ch. 17 $1.85

432A 348.14

July

WASHINGTON GAS INVOICES
FT. MYER FAMILY HOUSING 6-22--7-22-92
FY 92

CCF x 1.024 Therms

Bldg.	Therms	Late Charges	Amount Due
1	15.4		23.85
2	71.1		52.60
5	27.6		25.18
6A	67.1		11.26
7	3.1		10.20
8	45.1		31.10
11B	94.2		55.05
12A	2.0		9.51
13A	52.2		37.42
14A	19.5		14.25
15A	28.7		23.44
16A	57.0		50.69
17	15.4		13.83
19A	69.6		42.55
20A	30.7		25.35
21A	51.2		35.25
22A	44.0		30.54
23A	68.6		42.09
24A	58.4		37.32
25A	69.6		49.69
26A	—		— *
27A	63.5		39.70
28A	38.9		28.21
317B	85.0		50.75
426A	115.7		64.10
427A	75.8		45.45
428A	—		— *
431A	66.6		41.15
432A	—		— *
435A	34.8		26.29
436A	—		— *
439A	42.0		31.91
601	[illegible]		164.52
Totals	1925.3		1112.43

Credit Cr. of $110.00 from June

* Credits Bldg.	Amount
26A.	$137.50
428A.	58.59
432A	246.12
436A	8.83

Aug. 91

WASHINGTON GAS INVOICES
FT. MYER FAMILY HOUSING
FY 92

7-22--8-20-92

CCF x 1.021 Therms

Bldg.	Therms	Late Charges	Amount Due
1	16.3		24.27
2	36.8		27.77
5	24.5		23.65
6A	80.7		47.74
7	51.1		36.16
8	38.8		28.16
11B	54.1		36.31
12A	70.4		45.17
13A	31.7		24.84
14A	39.8		28.63
15A	49.0		32.92
16A	63.3		39.61
17	34.7		26.25
19A	67.4		41.52
20A	61.3		39.68
21A	55.1		35.77
22A	65.3		40.54
23A	65.3		40.57
24A	74.5		44.84
25A	64.3		47.16
26A	—		— *
27A	59.2		37.69
28A	28.6		23.39
317B	48.0		33.46
426A	111.3		62.04
427A	40.8		29.09
428A	206.2		44.45
431A	64.3		40.08
432A	—		— *
435A	35.7		26.71
436A	36.8		20.64
439A	37.8		29.94
50[redacted]	37[redacted]		168.15 ✓
Totals	2084.7		$1,226.62

* CREDITS

26A.	$95.98
432A.	156.54

9 - 1992

WASHINGTON GAS INVOICES
FT. MYER FAMILY HOUSING
FY 92

CCF x 1.025 Therms

Bldg.	Therms	Late Charges	Amount Due
1	75.1		63.13
2	102.5		85.33
5	32.7		26.45
6A	74.8		60.31
7	51.3		39.90
8	44.1		33.77
11B	66.6		46.80
12A	33.8		30.47
13A	59.2		51.06
14A	18.3		15.31
15A	22.5		23.51
16A	59.5		43.07
17	23.6		22.51
19A	51.5		43.15
20A	45.1		35.31
21A	45.1		32.31
22A	34.4		28.22
23A	1.3		13.91
24A	70.7		48.10
25A	75.9		58.09
26A	~~~~		~~~~ *
27A	65.6		45.36
28A	31.8		27.15
317B	61.5		44.15
426A	~~~~		~~~~ *
427A	35.9		29.36
428A	~~~~		~~~~ *
431A	57.4		40.94
432A	~~~~		~~~~ *
435A	30.8		24.06
436A	94.3		63.07
439A	43.1		35.49
501	378.2		197.71
Totals	1837.2		$ 1,285.35

* Cr.

26A	$ 45.67
426A	8.33
427A	9.64
432A	45.53

APPENDIX C

MEMORANDA AND LETTERS

Engineering Applications Consultants, P.C.

9004-B Crownwood Ct., Burke, Virginia 22015-1679; Phone (703) 978-0923; FAX: (703) 978-7331

MEETING REPORT

Project: Summer Steam Shut Down Study, Fort Myer, Virginia

Contract (Client Project) No.: DACA 31-89-C-0198 EAC Project No.: 92002.00

Place: Building 309, Fort Myer, Virginia Date: 14 FEB 94

Purpose: Discuss comments from the Prefinal Submittal of the Study

Person(s) Present	Code/Designation	Firm/Agency	Telephone
Mr. James Hawk	Project Manager	Balt. COE	410-962-6704
Mr. Ralph Gibson	Energy Coordinator	ANEN-IS	202-475-0919
Mr. Richard Rice	Chief O & M	DPW (Ft. Myer)	202-475-1880
Mr. Al Darvishian	MDW-DCSEH	(Ft. McNair)	202-475-1003
Mr. John Parker	ANMY	DPW (Ft. Myer)	703-696-3187
Mr. Raynard Sandwick	ANMY-PWO	DPW (Ft. Myer)	703-696-3812
Mr. Virender Puri	A/E Project Manager	EAC	703-978-0923
Mr. Ken Schram	Project Engineer	EAC	703-978-0923

1. The meeting commenced at 10:15 am.

2. The responses to all comments received from the various agencies were read and discussed. A copy of these comments, in original notation, is attached as a reference to these discussions.

Code ANEN-IS:

a) Comment 1; after a review of the list of buildings covered under this study by Ft. Myer personnel, it was determined that the scope is complete in identifying all buildings (21 total) that would be affected by a summer steam shut-down. It was noted that, as is shown in the study, the PX Service Station does not use steam during the summer.

b) Comment 2; in buildings that are single story, or where the roof is above the mechanical room ceiling, rising straight up with the vents is not a problem. In the "Old Guard" buildings, use of the existing chimneys is preferred. In the more modern, multi-story buildings, use of an utility chase or other concealed means is preferred. A limited survey of all multi-story buildings will be performed by EAC to verify aesthetically pleasing and feasible vent locations. After survey, EAC will issue a list of the "problem" buildings and proposed solutions for comments prior to submitting the final version of the study.

Code ANMY-PWO:

c) Comment 1; comment is identical to ANEN-IS #2. See item b) above.

d) Comment 2; preparation of a study to eliminate steam press requirements is not within the scope of work for this report. The existing steam presses will remain a load for any proposed equipment.

e) Comment 3; an analysis of solar energy use is not within the scope of work for this report. Previous studies for various buildings at Fort Myer have shown no significant benefit due to use, geographic, and climatic reasons.

f) Comment 4; comment was deleted.

g) Comment 5; building 423 "Commissary" will be demolished before the implementation of this study (probably within the year). Summary sheets and cost estimates will no longer include building 423. The study narrative will be revised to indicate the demolition of the Commissary.

h) Comment 6; in buildings where adequate mechanical room space for new equipment is not clearly available, additional sketches of the proposed installations will be provided. Also, additional sketches of the proposed vent locations for the "problem" buildings discussed in comment ANEN-IS #2 will be included.

i) Comment 7; the analysis provided for Alternative 4 of the study covers the various uses and limitations of high efficiency equipment. The anticipated results for Alternative 4 reflect an installation that utilizes high efficiency equipment where practical. Additional analysis in the study is not required.

j) Comment 8; the analysis for Alternative 3 provides for electric heating equipment in the typical "heater and storage tank" arrangements. Recovery must take place during and after peak water use if the systems are to be sufficient. Storage large enough for an entire day's use, allowing recovery only during night or electrical "off-peak" hours is not practical or feasible in many buildings. Deactivating electric heaters during the day is not considered as an alternative for energy savings because although savings will be realized, Alternative 3 would not be providing the same service as the other Alternatives. Additional analysis in the study is not required.

Code CESAM-EN-DF:

k) Comment 1; this comment which notes that the report is well documented and easy to understand was appreciated by EAC.

l) Comment 2; it was agreed that justifiable savings items include plant operations and sewer charges. Maintenance and repair of both the plant and the steam distribution system will not be included as savings. EAC will contact Mr. Robert Hennessee, Utilities Sales Officer at Fort Myer who provided the original cost data, to obtain a breakdown of the $400,902 used for plant operation, maintenance, and repair. Other factors such as the increased effectiveness of repairs, extended plant or equipment lives, and adverse or positive impacts to the distribution system due to seasonal shut-down will not be considered as the required data is inconclusive or non-existent. Speculations would not justifiable, and may not be correct in principle.

m) Comment 3; extra word "is" in last sentence of second paragraph on page 7 of Volume I will be deleted.

n) Comment 4; subparagraphs 1,2, and 3 on page 10 of Volume I will be deleted as they discuss programs that are no longer funded.

o) Comment 5; a comma will be added as needed in the first sentence of paragraph 6.3 on page 18 of Volume II.

p) Comment 6; "Building 407" will be corrected to "Building 405" as the discussion of the domestic water heating system on page 33 of Volume II pertains to Building 405.

q) Comment 7; this comment which notes that the explanation of the maintenance requirements is "very good" was appreciated by EAC. EAC also acknowledged that Mr. Fred Oshima of Fort Myer's Operations and Maintenance provided significant assistance in estimating the maintenance program Fort Myer would implement on the proposed equipment.

Code CENAB-EN-D:

r) Comment 1; the electricity savings of (-)695 MBTU/year listed in Table 1 for Alternative 3 is correct. This alternative which proposes the use of electric heating equipment only as practical (ie, heating of

smaller quantities of water), would still use more electricity than the present large boiler operation.

s) Comment 2; although the comment has merit, a redundant boiler of 65%, instead of 100%, in Alternative 2 will not be included as it results in a relatively minor reduction in initial construction costs of an alternative that will not be selected due to the architectural considerations.

t) Comment 3; the source of updated ECIP criteria, a telephone conversation with Mr. Gignilliat of the Army Center for Public Works which was included in Appendix C, will be added to the narrative of the report.

u) Comment 4; for the purposes of this study, the applicable criteria was examined and decided upon at the Interim Review meeting will remain as the basis of equipment selection. Reselection of slightly larger equipment will not be performed as it does not impact annual energy use. Impacts are limited to increases in construction costs only where present selections (of stock sizes) would not already cover the greater demand.

v) Comment 5; for the purposes of this study, the applicable criteria was examined and decided upon at the Interim Review meeting will remain as the basis of energy calculations. The 78°F is a valid operating point of HVAC equipment.

w) Comment 6; the narrative will indicate that replacement or salvage costs are not applicable as the life-cycle analyses of the study match the usable lives of the proposed equipment without overlap to the next cycle. Existing equipment remains in use for winter season service.

x) Comment 7; use of non-proprietary to achieve the proposed installations will be verified.

y) Comment 8; after the meeting, a telephone conversation between Mr. Schram of EAC and Mr. Goldgeier of the Baltimore District clarified the comment as a request for additional cross-references between the summary sheets of the calculations and the listings of the embedded spreadsheet formulas, any supporting data, or intermediate conclusions within the calculations. These references will be made.

z) Comment 9; the figure of 1,910.6 kbtu/hr does include the 80.0 kbtu/hr demand of Building 249. At 80.8 kbtu/hr and with no steam press demands, Building 249 "rides the fence" for being included in a semi-central distribution only because of its location relative to the other buildings. The intent is to remove Building 249 from the system. This will be coordinated.

aa) Comment 10; in developing prospective models for water use patterns, several sources were referred to. These references will remain in the calculations as they are important in collaborating estimates of existing building use with central plant steam production, thus justifying savings calculations and energy use patterns. All proposed installations are based on the Army technical manuals (and National Standard Plumbing Code) discussed previously. No changes are needed. (Incidently, energy use patterns are beyond the scope of the Standard Plumbing Code.)

ab) Comment 11; ECIP Guidance of 10 Jan 94 was released after the submission of this study -- December 1993. Unless SIR criteria are significantly different, criteria as referenced will remain effective. Metric units are not in the scope of work for preparation of this study.

ac) Comment 12; projects need to be assessed in complete form only. Individual buildings cannot be constructed because this does not allow a central plant shut-down, thus individual SIR's are not valid.

ad) Comment 13; notation as an "ECIP" project will be added to the title blocks of the 1391 form.

3. Mr. Rice may forward additional comments pertaining to the Executive Summary for purposes of the presentation of the final report. Mr. Hawk will also verify items or topics to be highlighted during the presentation.

4. Mr. Gibson will examine the 1391 project implementation forms more closely and coordinate with EAC any changes that should be made for successful processing after the final submission.

5. "Central Steam Plant Summer Shut-Down Feasibility Study" will be added to the cover sheets of the report.

6. With the inclusion of the above comments, the next submittal will be the Final Submission and will be distributed to the appropriate agencies by 15 March 1994. This submission date is based on timely correspondence to the items cited in paragraphs 2.b, 2.1, 3, and 4 above.

7. The meeting was adjourned at 12:30 pm.

Prepared by K. Schram

cc: meeting attendees
Mr. Battaglia, CESAM-EN-CM
cc, pm (internal files)

92002\meetings\021494

Engineering Applications Consultants, P.C.

9004-B Crownwood Ct., Burke, Virginia 22015-1679; Phone (703) 978-0923; FAX: (703) 978-7331

TELEPHONE CONVERSATION SUMMARY

Project: SUMMER STEAM SHUT-DOWN STUDY, FT. MYER, VA

Project No.: DACA 31-89-C-0198 EAC Project No.: 92002.00

From: KEN SCHRAM Telephone: 703-978-0923 Date: 14 DEC 93

To: BOB HENNESSEE Telephone: 703-696-3811 Time: 10:30 AM

Discussion:

BASEWIDE TOTAL ENERGY CONSUMPTION FOR 1992: 2,071,000 MBTU ($\times 10^6$)

ROUTING AND TRANSMITTAL SLIP - Date 19 Nov 93.

TO: (Name, office symbol, room number, building, Agency/Post)

	Initials	Date
1. KEN SHRAM. — EAC		
2.		
3.		
4.		
5.		

	Action		File	Note and Return
	Approval		For Clearance	Per Conversation
X	As Requested		For Correction	Prepare Reply
	Circulate		For Your Information	See Me
	Comment		Investigate	Signature
	Coordination		Justify	

REMARKS

Ken,

Please note: Cost figures for chemicals for Water Treatment and one-time setup costs for water treatment equipment have not been entered on cost worksheet

I've been waiting for vendor quote, can't get in touch w/ him so I'll phone in figures soon as received.

DO NOT use this form as a RECORD of approvals, concurrences, disposals, clearances, and similar actions

FROM: (Name, org. symbol, Agency/Post) [signature]

Room No.—Bldg. 308

Phone No. 703-696-3804

5041-102

OPTIONAL FORM 41 (Rev. 7-76)
Prescribed by GSA
FPMR (41 CFR) 101-11.206

• U.S. GPO: 1990 — 262-180

E S T I M A T E

O & M Costs of Proposed Individual Boilers/Water Heaters

RE: Summer Steam Study
Ft. Myer, VA
EAC Proj. No. 92002.0(

PROPOSED EQUIPMENT:

DOMESTIC HOT WATER HEATERS: (Nat Gas w/ Powered Burner)

Bldg. No.	Energy Requirement (kBTU/hr)	Storage (gals)	Recovery (GPH)	Operational Visits	Off-Season Overhaul
249	80.8	141	161.5	1/month	1/yr
402	545.6	952	1,091.3	1/month	1/yr
405	31.1	53	1,636.9	1/month	1/yr
407	173.3	267	346.7	1/month	1/yr
411	54.2	173	108.3	1/month	1/yr
416	288.1	503	576.2	1/month	1/yr
423	180.0	360	360	1/month	1/yr
450	131.9	422	263.9	1/month	1/yr
469	288.1	250	250	1/month	1/yr

LOW PRESSURE STEAM BOILERS (Nat Gas Fired):

Bldg. No.	Energy Requirement (kBTU/hr)	Operational Visits	Boiler Water Treatment	Off-Season Overhaul
400	583.7	1/week	3/week	1/yr
403	818.5	1/week	3/week	1/yr
404	3,478.2	1/week	3/week	1/yr
406	818.5	1/week	3/week	1/yr
501	2,000.0	1/week	3/week	1/yr
525	1,708.3	1/week	3/week	1/yr

HIGH PRESSURE STEAM BOILERS (Nat Gas Fired):

Bldg. No.	Energy Requirement (kBTU/hr)	Operational Visits	Boiler Wtr Treatment	Off-Season Overhaul	Boiler Inspection
246	597.7	1/day	3/week	1/yr	2/yr
247	227.0	1/day	3/week	1/yr	2/yr
248	394.7	1/day	3/week	1/yr	2/yr
250	248.1	1/day	3/week	1/yr	2/yr
251	362.3	1/day	3/week	1/yr	2/yr
410	220.0	1/day	3/week	1/yr	2/yr

BASIS FOR ESTIMATE:

1. Operational period for the utilization of proposed individual boilers/water heaters are based on six (6) months per year (May - Oct).

2. O & M manpower requirements enunciated are based on projections provided by the Ft. Myer Heating Shop (Mr. Wm. A. WOLFE, Foreman). Fort Myer requirements meet or exceed requirements prescribed in AR420-49.

3. Shop manhour cost are FY "93 data.

4. Other cost figures are based on FY "93 data or from quotations from local Vendors.

BASIS FOR CALCULATIONS:

1. Operational Visits: .5 manhour per visit

2. Seasonal Overhaul : 8 manhours for boiler size up to 1,000 kBTU/hr.
   12 manhours for boiler size 1,000 - 5,000 kBTU/hr.

3. Water Treatment : .5 hr. per visit X 3/week = 1.5 hrs. per week
   (Includes: Draw sample and test, fill chemical tank, operational check of automatic feeder equip., etc.)

4. Boiler Inspection : "Cold" and "Hot" inspections on Hi Press. Steam Boilers by approved and recognized Insurance Company.
   $265.00 ea. for "Cold". $251.00 ea. for "Hot" = $516.0

5. Material Costs:

   a. Parts and materials associated with performing routine PM functions and annual overhaul (lubricants, filters, gaskets, etc.):

      (1) Dom. Hot Wtr Heaters w/ powered burners: $10,00/yr.

      (2) Low Press. Steam Boilers (forced draft): $40.00/yr

      (3) Hi Press. Steam Boilers (forced draft) : $60.00/yr

6. Chemicals Cost for Boiler Water Treatment:

   Projected costs were derived through consultations w/ Mr. Dave VODVARKA of NUTMEG Technology Inc., New Haven, Connecticut who is currently providing Boiler Water Treatment services for Ft. Myer.

7. Hourly man-hour cost for Ft. Myer Heat Shop: $24.76 per hour.

O & M COST CALCULATIONS WORKSHEET

DOMESTIC HOT WATER HEATERS: (9 ea.)

Operational Visits: — Annual Cost

.5 hr ea. X 1/mo X 6 mos = 3 hrs/yr ea. X 9 = 27 hrs/yr X $24.76= $ 668.52

Off-season Overhaul:

2 hrs ea. X 1/yr. = 2 hrs/yr ea. X 9 = 18 hrs/yr X $24.76 ——— = 445.68

PM Materials Cost:

$10.00/yr ea. X 9 ———————————————————— = 90.00

LOW PRESS. STEAM BOILERS: (6 ea.)

Operational Visits:

.5 hr. ea X 1/wk X 26 wks = 13 hrs/yr ea. X 6 = 78 hrs/yr X 24.76= 1,931.28

Off-season Overhaul:

6 hrs. ea X 1/yr = 6 hrs/yr ea. X 6 = 36 hrs/yr X $24.76 ——— = 891.36

Boiler Water Treatment:

.5 hr/visit X 3/wk = 1.5 hrs ea. X 26 wks = 39 hrs/yr ea X 6 =
234 hrs/yr X $24.76--- = 5,793.84

PM Materials Cost:

$40.00/yr. ea. X 6 ———————————————————— = 240.00

HIGH PRESS. STEAM BOILERS: (6 ea.)

Operational Visits:

.5 hr ea. X 1/day X 125 days = 62.5 hr/yr ea. X 6 = 375 hrs/yr X
$24.76 —= 9,285.00

Off-season Overhaul:

6 hrs ea. X 1/yr = 6 hrs/yr ea. X 6 = 36 hrs/yr X $24.76 ——— = 891.36

Boiler Water Treartment:

.5 hr/visit X 3/wk = 1.5 hrs ea. X 26 wks = 39 hrs/yr ea. X 6 =
234 hrs/yr X $24.76 —= 5,793.84

PM Materials Cost:

$60.00/yr ea. X 6 ———————————————————— = 360.00

Boiler Inspection (semi-annual):

$516.00/yr ea. X 6 ———————————————————— = 3,096.00

--Chemicals for Water Treatment:

Vendor estimated annual requirement for 12 Steam Boilers: = _____

TOTAL MAN-HOURS: = 1,038 TOTAL O & M COSTS: ..... $

One-time Water Treatment Equipment setup cost for 12 Steam Boilers:

(Tanks, feeder pumps, etc.) VENDOR QUOTE:

ESTIMATED BY: Fred K. Oshima
FRED K. OSHIMA (703) 696-3804

O & M COST CALCULATIONS WORKSHEET

DOMESTIC HOT WATER HEATERS: (9 ea.)

Operational Visits: — Annual Cost

.5 hr ea. X 1/mo X 6 mos = 3 hrs/yr ea. X 9 = 27 hrs/yr X $24.76 = $ 668.52

Off-season Overhaul:

2 hrs ea. X 1/yr. = 2 hrs/yr ea. X 9 = 18 hrs/yr X $24.76 ——— = 445.68

PM Materials Cost:

$10.00/yr ea. X 9 ——————————————————— = 90.00

LOW PRESS. STEAM BOILERS: (6 ea.)

Operational Visits:

.5 hr. ea X 1/wk X 26 wks = 13 hrs/yr ea. X 6 = 78 hrs/yr X 24.76 = 1,931.28

Off-season Overhaul:

6 hrs. ea X 1/yr = 6 hrs/yr ea. X 6 = 36 hrs/yr X $24.76 ——— = 891.36

Boiler Water Treatment:

.5 hr/visit X 3/wk = 1.5 hrs ea. X 26 wks = 39 hrs/yr ea X 6 = 234 hrs/yr X $24.76--- = 5,793.84

PM Materials Cost:

$40.00/yr. ea. X 6 ——————————————————— = 240.00

HIGH PRESS. STEAM BOILERS: (6 ea.)

Operational Visits:

.5 hr ea. X 1/day X 125 days = 62.5 hr/yr ea. X 6 = 375 hrs/yr X $24.76 —= 9,285.00

Off-season Overhaul:

6 hrs ea. X 1/yr = 6 hrs/yr ea. X 6 = 36 hrs/yr X $24.76 ——— = 891.36

Boiler Water Treartment:

.5 hr/visit X 3/wk = 1.5 hrs ea. X 26 wks = 39 hrs/yr ea. X 6 = 234 hrs/yr X $24.76 —= 5,793.84

PM Materials Cost:

$60.00/yr ea. X 6 ——————————————————— = 360.00

Boiler Inspection (semi-annual):

$516.00/yr ea. X 6 ——————————————————— = 3,096.00

--Chemicals for Water Treatment:

Vendor estimated annual requirement for 12 Steam Boilers: = 7,346.00*

TOTAL MAN-HOURS: = 1,038 TOTAL O & M COSTS: ..... $ 36,832.88

One-time Water Treatment Equipment setup cost for 12 Steam Boilers:

(Tanks, feeder pumps, etc.) VENDOR QUOTE: ..... $ 6,528.00*

ESTIMATED BY: Fred K. Oshima

FRED K. OSHIMA (703) 696-3804

* PER TELEPHONE CONVERSATION WITH MR. OSHIMA, 19NOV93, 2:30 PM.

Engineering Applications Consultants, P.C.

9004-B Crownwood Ct., Burke, Virginia 22015-1679; Phone (703) 978-0923; FAX: (703) 978-7331

FAX TRANSMITTAL

TO: U.S. Army; MDW, DPW; Ft. Myer, VA
Mr. Richard Rice, 703-696-3804
ATTN: Mr. Fred Oshima, 703-696-3814 ←
Mr. Bruce Murphy
CLIENT PROJ. NO. DACA 31-89-C-0198
FAX NO. 703-696-6422

DATE: September 23, 1993 (NOV. 2, 1993)
RE: Summer Steam Shut Down Study
Fort Myer, Virginia
EAC PROJECT NO. 92002.00

Gentlemen:

We are sending you the following items consisting of 5 pages including cover sheet.

Hard copy to be sent: ☐ YES ☒ NO

DESCRIPTION

1. Revised calculations of domestic hot water requirements and total demand (output capacity requirements) for new boilers/water heaters.
2. Guidance for operational visits by roving personnel to individual boilers from AR 420-49 Update.

REMARKS We are requesting your assistance in determining the anticipated needs for operating and maintaining the local boilers and water heaters.

We are looking for manhours and costs of all labor and materials. Consider all costs of seasonal start-up and shut-down, water treatment, repairs, time to log visits, adjustments, emergency calls, etc.; based on your experiences at the base.

After you have had time to determine some appropriate costs, we would like to meet with you again to discuss the figures and any qualifiers you may have. Your help is greatly appreciated.

If you do not receive the required number of pages, please contact sender at (703) 978-0923.

SENDER Ken Schram

92002\092393

EQUIPMENT SIZE

Equipment Requirements: Domestic Hot Water & Steam

Building Number	Utilization	Domestic Hot Water Heating					Other Steam Requirements			Total Output Energy Requirement
		Storage (gallons)	Recovery (gal/hr)	Heat (kBTU/hr)	Steam * (lbs/hr)	Pressure * (psig)	Steam (lbs/hr)	Pressure (psig)	Heat (kBTU/hr)	(kBTU/hr) ⇒
246	Enlisted Barracks	853	977.8	488.9	471	10	121	85	108.8	597.7
247	Enlisted Barracks	221	253.2	126.6	133	11	112	85	100.4	227.0
248	Enlisted Barracks	324	371.0	185.5	195	11	232	85	209.2	394.7
249	Enlisted Barracks	141	161.5	80.8	85	8	0	---	0.0	80.8
250	Enlisted Barracks	316	362.3	181.2	190	8	74	85	66.9	248.1
251	Enlisted Barracks	457	523.8	261.9	274	8	112	85	100.4	362.3
400	Band	200	233.3	116.7	122	8	486	8	467.0	583.7
402	Enlisted Barracks	952	1,091.3	545.6	581	20	0	---	0.0	545.6
403	Enlisted Barracks	1,429	1,636.9	818.5	872	20	0	---	0.0	818.5
404	Dining Facility	2,000	2,600.0	1300.0	1,365	10	2,305	15	2,178.2	3,478.2
405	Recreation Center	53	62.2	31.1	33	10	0	---	0.0	31.1
406	Enlisted Barracks	1,429	1,636.9	818.5	872	20	0	---	0.0	818.5
407	NCO Club	267	346.7	173.3	182	10	0	---	0.0	173.3
410	Enlisted Barracks	286	327.4	163.7	172	10	0	---	0.0	163.7
411	Bowling Center	173	108.3	54.2	57	7	0	---	0.0	54.2
416	Enlisted Barracks	503	576.2	288.1	307	20	0	---	0.0	288.1
423	Commissary	360	360.0	180.0	189	10	0	---	0.0	180.0
450	Main Exchange	422	263.9	131.9	138	10	0	---	0.0	131.9
452	PX Service Station	0	0.0	0.0	---	---	0	---	0.0	0.0
469	Child Care Center	250	250.0	125.0	130	2	0	---	0.0	125.0
501	Tenczar Terrace	3,200	4,000.0	2000.0	2,116	15	0	---	0.0	2,000.0
525	Rader Clinic	747	871.1	435.6	456	8	1,326	8	1,272.7	1,708.3
									Grand Total (Equipment Capacities) =	13,010.6

* Data provided for option to reuse existing steam-fired domestic hot water heating equipment during the summer period

× 1,0(
= BTU/

Domestic Hot Water Requirements

Building Number	Utilization	N People (persons)	G Use/person (gal/day)	B Avg. Period (hours)	D Peak Period (hours)	A Avg. Req. (gal/hr)	P Peak Req. (gal/hr)	S Storage (gallons)	R Recovery (gal/hr)	Q Heat Output (kBTU/hr)
246	Enlisted Barracks	224	30	14	6	480	1,120	853	977.8	488.9
247	Enlisted Barracks	58	30	14	6	124	290	221	253.2	126.6
248	Enlisted Barracks	85	30	14	6	182	425	324	371.0	185.5
249	Enlisted Barracks	37	30	14	6	79	185	141	161.5	80.8
250	Enlisted Barracks	83	30	14	6	178	415	316	362.3	181.2
251	Enlisted Barracks	120	30	14	6	257	600	457	523.8	261.9
400	Band	60	15	6	3	150	300	200	233.3	116.7
402	Enlisted Barracks	250	30	14	6	536	1,250	952	1,091.3	545.6
403	Enlisted Barracks	375	30	14	6	804	1,875	1,429	1,636.9	818.5
404	Dining Facility	1,500	10	10	5	1,500	3,000	2,000	2,600.0	1,300.0
405	Recreation Center	120	2	6	3	40	80	53	62.2	31.1
406	Enlisted Barracks	375	30	14	6	804	1,875	1,429	1,636.9	818.5
407	NCO Club	200	10	10	5	200	400	267	346.7	173.3
410	Enlisted Barracks	75	30	14	6	161	375	286	327.4	163.7
411	Bowling Center	130	3	6	2	65	195	173	108.3	54.2
416	Enlisted Barracks	132	30	14	6	283	660	503	576.2	288.1
423	Commissary	180	6	4	2	270	540	360	360.0	180.0
450	Main Exchange	475	2	6	2	158	475	422	263.9	131.9
452	PX Service Station	5	0	6	2	0	0	0	0.0	0.0
469	Child Care Center	125	6	4	2	188	375	250	250.0	125.0
501	Tencza Terrace	480	40	8	4	2,400	4,800	3,200	4,000.0	2,000.0
525	Rader Clinic	224	15	6	3	560	1,120	747	871.1	435.6

Grand Total Peak Boiler Heat Output = 8,506.9

- Entering Water Temperature (degrees Fahrenheit) = 40
- Hot Water Supply Temperature (degrees Fahrenheit) = 100

- Storage capacity based on percentage usable volume = 75%

UPDATE

2-7. Operating personnel requirements-roving operation

a. Maximum use will be made of roving patrol operators for boiler and heating plant operation. Gas-fired and oil-fired heating units should be equipped with automatic controls and firing systems, and safety devices to the extent necessary to require minimum operational surveillance. Such plants should be equipped with surveillance equipment for monitoring operations at a centrally manned location to the extent feasible/practical. Audible and visual alarms may be used where applicable.

b. Personnel used for operational visits will be certified per paragraph 2-6*b*. Operational visits will be of the duration required to observe a complete cycle of operation and perform the scheduled operator preventive maintenance. Leaks, faulty operation, and any equipment failures will be reported (corrected if possible) immediately and made a matter of record at the time of visit. Roving operators will not leave heating equipment in an emergency or failing condition until the situation is under the control of the appropriate repair shop, or has been operator corrected.

c. Frequency of operational and preventive maintenance visits in the smaller automatic gas and light (No. 2) oil-fired systems is a matter of local judgment based on the criticality of service, sophistication of the equipment, and the extent of monitoring or control used. In all cases, frequency of scheduled visits will be based on the surveillance required to ensure that heating systems are operational and safe when they are needed.

d. Visits by roving operators will be recorded by a watchman's clock or other positive means, and individual plant logs will be kept to record preventive maintenance and emergency situations and failures.

2-8. Boiler and heating plant operation-constant attendance

a. The extent of constant attendance in larger central steam boiler and high temperature water systems, and the larger automatic commercial building type systems, is a matter of local judgment based on the individual plant circumstances. Criteria for staffing should be based on the criticality of service; size and complexity of the equipment; extent of the maintenance responsibility required by operators; whether "in plant" maintenance is used; the availability of local shop support; and plant location. The critical factors in determining staffing requirements must be the safe, efficient, reliable, and environmentally compatible operation of the equipment when its use is required.

b. Table 2-1 provides guidance for frequency of operational visits for smaller heating plants and suggested staffing for the larger central heating and boiler plants. Personnel requirements for the staffing of energy monitoring and control systems as they relate to boiler plants and heating systems must be consistent with the operating and use factors and critical nature of the equipment as discussed in the preceding paragraphs. Consideration should also be given to any local or State heating or power plant staffing guidance which may be applicable, especially if in conjunction with operator certification and environmental requirements.

Table 2-1
Operational Visits and Staffing-Heating and Boiler Plants

Operational Visits

Plant output capacity, BTU per hour	Maximum operating pressure	Fuel	Frequency of visit
Up to 300,000	15 psi steam/30 psi water	Gas/oil	2 per season equal spaced
360,000 to 1,700,000	15 psi steam/30 psi water	Gas	1 per 3 months
		Oil	1 per month
		Stoker	2 per day
1,700,000 to 5,000,000	15 psi steam/30 psi water	Gas	1 per week
		Oil	1 per day
		Stoker	1-3 per shift
5,000,000 to 14,000,000	15 psi steam/30 psi water	Gas	1 per day
		Oil	1 per shift
		Stoker	2-4 per shift

Plant output capacity, BTU per hour	Maximum operating pressure	Fuel	Frequency of visit
Up to 1,400,000	Over 15 psi steam	Gas	1 per week
		Oil	1 per week
		Stoker	1-2 per shift
1,400,000 to 3,500,000	Over 15 psi steam	Gas	1 per day
		Oil	1 per shift
		Stoker	2-3 per shift
3,500,000 to 14,000,000	Over 15 psi steam or 30 psi water	Gas	1 per shift
		Oil	1-2 per shift
		Stoker	2-4 per shift

Constant Attendance

14,000,000 to 100,000,000	Over 15 psi steam or 30 psi water	Gas	1 man per shift
		Oil	1 man per shift
		Stoker	as required per equipment
Over 100,000,000	Over 15 psi steam or 30 psi water	All fuels	constant per requirements

Notes:
1. Output capacity of plant determined per performance factors in AR 87-100-series.
2. This survey information is provided for guidance only. Actual operational and staffing requirements must be gaged by the factors discussed in the narrative of paragraph 2-6. Manning will also be substantially influenced by a reduction in plant loading to the extent that fewer boilers and less equipment may be operated to satisfy the reduced load.

[OTHER BUILDINGS]
[BLDGS. 404, 501, 525]
[INDIVIDUAL BOILERS @ BLDGS. 246 → 251]
[1 BOILER SERVING BLDGS. 246 → 251]

UPDATE

Engineering
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A Professional
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9004-B Crownwood Ct.
Burke, Virginia 22015-1630
(703) 978-0923

October 26, 1993

Department of the Army
Baltimore District Corps of Engineers
P.O. Box 1715
Baltimore, Maryland 21203

Attention: Mr. James Hawk (CENAB-EN-D)

Re: Summer Steam Shut Down Study
Fort Myer, Virginia
A/E Contract No: DACA 31-89-C-0198
EAC Project No: 92002.00

Gentlemen:

Discussion during the interim review meeting stressed the importance of making good assumptions of the operation and maintenance costs associated with the proposed alternatives. At that meeting, it was established that we would provide the Ft. Myer O&M office with capacities and pertinent data of proposed equipment. From this data, the Ft. Myer O&M office would develop anticipated service requirements, and costs, based on their experiences of daily operations.

We have recalculated equipment capacities and sent the data to Ft. Myer on September 23, 1993. Due to personnel changes and restructuring in the Operations and Maintenance Division at Ft. Myer, the anticipated operating requirements and costs to be included in this study have not been determined.

At the review meeting, the date for the next submission of the study was set for October 30, 1993. In order to incorporate the data being developed by Ft. Myer, we are requesting that the next submission be delayed to a date 14 days after these operating costs have been calculated and agreed upon.

Thank you for your help in this matter.

Sincerely yours,

ENGINEERING APPLICATIONS CONSULTANTS, P.C.

Virender Puri

Virender Puri, P.E.
President

vp:ks

cc: cc, pm
92002\letters\102693

Engi. ering Applications Consulta s, P.C.

9004-B Crownwood Ct., Burke, Virginia 22015-1679; Phone (703) 978-0923; FAX: (703) 978-7331

TELEPHONE CONVERSATION SUMMARY

Project: Summer Steam Shutdown – Ft. Myer

Project No.: _____ EAC Project No.: 92002.00

From: Bob Hennessey Telephone: 703-696-3811 Date: 9/7/93

To: Ben Schram Telephone: 703-978-0923 Time: 11:05 am

Discussion:

Regarding rates for Natural Gas, according to conversations w/ Washington Gas, as long as Ft. Myer retains the ability to burn #6 fuel oil, the rate for natural gas will not jump higher.

Using #2 fuel oil instead of #6 fuel oil does not impact the rate.

– Operations and the "ability to use #6 fuel oil" (not necessarily the use of..) will be discussed w/ Mr. Richard Rice; pertaining to environmental concerns, etc.

Engineering Applications Consulta. .s, P.C.

9004-B Crownwood Ct., Burke, Virginia 22015-1679; Phone (703) 978-0923; FAX: (703) 978-7331

TELEPHONE CONVERSATION SUMMARY

Project: Ft. Myer - Summer Steam Shutdown

Project No.: DACA 31-89-C-0198 EAC Project No.: 92002.00

From: Ken Schram Telephone: 703-978-0923 Date: 9-2-93

To: Mr. Hank Gignilliat Telephone: 703-704-1545 Time: 2:00 pm

Discussion:

1. Hank Gignilliat (or. GINLET) works for the Army Center for Public Works and is knowledgable on ECIP Project Requirements.

2. Revision to the latest ECIP guidance (14 NOV 92) provides that qualified projects will have an SIR equal to or greater than 1.25. This is a change from the previous requirement of SIR ≥ 1.0.

3. Also, a statement that the project will not be affected by base closure or realignment must be included in the programming documents.

92002.00 CC

ROUTING AND TRANSMITTAL SLIP Date SEP 2 ~~Aug~~ 93

TO: (Name, office symbol, room number, building, Agency/Post)	Initials	Date
1. Mr KEN Schram		
2. Engineering Applications Consultants		
3. 9004-B CROWNWOOD COURT BURKE, VA 22015		
4.		
5.		

	Action		File		Note and Return
	Approval		For Clearance	X	Per Conversation
	As Requested		For Correction		Prepare Reply
	Circulate		For Your Information		See Me
	Comment		Investigate		Signature
	Coordination		Justify		

REMARKS

Per telecom 2 Aug 93, 15:00 hrs.; forwarded are excerpts from AR 11-27 as pertains to domestic hot water temp requirements.

Rec'd: Cover & Pg. 9, Sects. 3-5 & 3-6.
7SEP93

Fred Schram
(703) 696-3814
DPW-OMD-U
BLDG 326, FT MYER

DO NOT use this form as a RECORD of approvals, concurrences, disposals, clearances, and similar actions

FROM: (Name, org. symbol, Agency/Post)	Room No.—Bldg.
	Phone No.

5041-102

GPO : 1987 0 - 170-636

OPTIONAL FORM 41 (Rev. 7-76)
Prescribed by GSA
FPMR (41 CFR) 101-11.206

Engi..ering Applications Consulta..s, P.C.

9004-B Crownwood Ct., Burke, Virginia 22015-1679; Phone (703) 978-0923; FAX: (703) 978-7331

MEETING REPORT

Project: Summer Steam Shut Down Study, Fort Myer, Virginia

Contract (Client Project) No.: DACA 31-89-C-0198 EAC Project No.: 92002.00

Place: Building 308, Fort Myer, Virginia Date: 11-24-92

Purpose: Discuss comments from the Interim Submittal of the Study

Person(s) Present	Code/Designation	Firm/Agency	Telephone
Mr. James Hawk	Project Manager	Balt. COE	410-962-6704
Mr. Ralph Gibson	Energy Coordinator	DCSEH	202-475-0919
Mr. Richard Rice	Chief O & M	DPW (Ft. Myer)	703-696-3804
Mr. Fred Oshima	O & M	DPW (Ft. Myer)	703-696-3814
Mr. Virender Puri	A/E Project Manager	EAC	703-978-0923
Mr. Ken Schram	Engineer	EAC	703-978-0923

1. The meeting commenced at 10:15 am. Mr. Richard Rice's telephone number will be (202) 475-1880 after 26 September 1993.

2. The responses to all comments received from the various agencies were read and discussed. A copy of these responses is attached for reference to these minutes of the meeting. Comments that had significant discussion or will receive action other than as indicated on the attached sheets are as follows:

   Code CESAM-EN-CM:

   a) Comment 4; the study will be referred to as "conducted in support of the National Energy Conservation Policy ..." rather than "funded under the National Energy Conservation Policy ...".

   b) Comment 7; regarding fuel rates, Ft. McNair's rate for interruptible natural gas is currently higher than Ft. Myer's because of the use of No. 2 fuel oil as a back-up, rather than a less refined and less expensive heavier oil. Washington Gas has not increased the rate for Ft. Myer although the base has switched to No. 2 oil as a back-up. It is anticipated that there will be a substantial rate increase (approximately 10 cents per therm or almost 25%)in the near future. EAC shall contact Bob Hennessee at Ft. Myer and receive a value for the anticipated rate within 10 days.

   All required operational needs for the proposed boiler systems will be discussed with the Ft. Myer O & M Division. The refined estimate of these needs will be included in the calculations.

   c) Comment 9; the indoor conditions will be set to 78°F/50% RH.

   d) Comment 12; EAC shall contact Mr. Hank Gignilliat (703-704-1545) at the Center for Public Works to obtain any changes to the ECIP Criteria since the 14 November 92 issue.

   e) Comment 13; the assumption is valid.

   f) Comment 15; reportedly, Building 405 has only restrooms and a "kitchenette". The energy use calculations should be based on water temperatures that are in accordance with regulation 11-27. The 1989 version of this regulation provides for 95°F hot water for personal

hygiene. Fred hima will obtain the current v ion of this document and provide EAC with the current information wit..in 10 days.

g) Comment 20; to expedite the making of good operation and maintenance assumptions for the proposed alternatives, within 10 days EAC shall send a listing of the proposed equipment to be installed under each alternative to Mr. Rice. Following, a meeting between EAC and DPW shall be scheduled to discuss these O & M needs and costs (materials & labor) in detail.

Code CENAB-EN-D:

h) Comment 3; the indoor conditions will be set to 78°F/50% RH.

i) Comment 7; see discussion of item 2.f) above.

j) Comment 8; temperatures will be adjusted in accordance with regulation 11-27. See discussion of item 2.f) above. Provisions for point-of-use temperature boosting will be included in the calculations.

k) Comment 10; the paragraph on page 35 "Other Steam Uses" describing the operation of food service equipment will be elaborated.

l) Comment 12; the uses of Building 469 will verified with a limited survey. Water temperatures will be adjusted for the determined uses of the building. Limited surveys will also be performed on Buildings 403, 405, 410, 416, and 452 to establish more accurate models. This survey work will be coordinated through Fred Oshima. Mr. Oshima will obtain a listing of the appropriate contact personnel at each building.

m) Comment 14; additional costs for repair of the distribution system due to excessive downtime will be deleted.

n) Comment 18; a statement will be added to the narrative explaining that the point-of-use loss of steam from the system is essentially zero and that the costs for make-up water will be nearly zero for the local boiler alternatives.

o) Comment 23; Cost Engineering will not be required to review the estimates as they are of a "study" nature and without detailed construction drawings. The basis for the cost estimates will be stated.

Code ANMY-ENO:

p) Comment 2; see discussion of item 2.b) above.

Code ANMY-ENE-D:

q) Comment 1a; see discussion of item 2.l) above.

r) Comment 1b; see discussion of item 2.f) above.

s) Comment 2; from the above discussions, specifically item 2.l), the next submittal will include all of the mentioned changes and shall constitute a pre-final (95%) submittal.

t) Comment 3; only the alternatives covered in the interim submittal will be analyzed further.

3. The next submittal shall be the Pre-Final (95%) and shall be distributed to the appropriate agencies by 30 October 1993.

4. The meeting was adjourned at 12:45 pm.

Prepared by K. Schram

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9004-B Crownwood Ct.
Burke, Virginia 22015-1630
(703) 978-0923

August 12, 1993

Department of the Army
Baltimore District Corps of Engineers
P.O. Box 1715
Baltimore, Maryland 21203

Attention: Mr. James Hawk (CENAB-EN-D)

Re: Summer Steam Shut Down Study
Fort Myer, Virginia
A/E Contract No: DACA 31-89-C-0198
EAC Project No: 92002.00

Gentlemen:

We have responded to all comments received pertaining to the Interim Submittal of the above referenced project. Some of these comments express needs, which if were to be met, would require changes in the scope of work for the study. Therefore, to thoroughly discuss the needs of the users, and to determine the direction to proceed for the final submittal , we feel that an interim review meeting is necessary.

To avoid any further delay in the completion of this study, we are requesting that the interim review meeting be scheduled for Wednesday, 25 August 1993.

Please confirm that this schedule is acceptable to all concerned parties. Thank you for your help in this matter.

Sincerely yours,

ENGINEERING APPLICATIONS CONSULTANTS, P.C.

Kenneth Schram, P.E.
Project Manager

cc: cc, pm

92002\letters\81293

Engineering
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9004-B Crownwood Ct.
Burke, Virginia 22015-1630
(703) 978-0923

August 10, 1993

Department of the Army
Baltimore District Corps of Engineers
P.O. Box 1715
Baltimore, Maryland 21203

Attention: Mr. James Hawk (CENAB-EN-D)

Re: Summer Steam Shut Down Study
Fort Myer, Virginia
A/E Contract No: DACA 31-89-C-0198
EAC Project No: 92002.00

Gentlemen:

The following are our responses to additional comments received from CESAM-EN-CM by Mr. Battaglia, regarding the interim submittal of the above referenced project. These responses are open for discussion, and we hope that you call us to discuss them.

Sincerely yours,

ENGINEERING APPLICATIONS CONSULTANTS, P.C.

Kenneth Schram, P.E.
Project Manager

Enclosures

cc: cc, pm

92002\letters\81093

Responses to Review Comments:

Summer Steam Shut Down Study, Fort Myer, Virginia, Interim Submission

Comment No.	Location	Comment and Response
Code CESAM-EN-CM		
1	General	Comment: Page 1 & 2 comments refer to Vol I; page 3 comments refer to Vol II. Response: - - - -
2	General	Comment: Study appears to be on the right track. Areas with room for improvement are listed below. Response: - - - -
3	Contents	Comment: Table of Contents should list contents of both volumes. Response: Will comply.
4	Vol 1, 1	Comment: 3rd par; The study is <u>not</u> funded under NECPA. Recommend not mentioning the funding source. Response: Funding source for the study will be omitted.
5	General	Comment: Define the abbreviation "MBTU", as used in the report. Normally MBTU means 1 million BTU; however in this report it appears to be used as 1 thousand BTU. Response: The intention for MBTU is for 1 million BTU. All instances will be verified.
6	Vol 1, 4	Comment: Provide title for table at bottom of page, and include the non-energy savings. Response: Will comply.
7	Vol 1, 5&6	Comment: Refinement of the operations and maintenance cost analysis may be needed. Recommend further discussion between AE and Base O&M personnel regarding: a. Current fuel prices b. Factors affecting fuel rates, i.e. interruptible service, backup fuels, environmental factors, etc. c. Tradeoffs on labor costs for operation and maintenance. Response: Will comply to substantiate values and refine calculations.
8	General	Comment: Attached is AR 420-49, 22 Jun 90, providing guidance on staffing boiler operations, applicable to recommendations in Comment 7.

Response: The document has been read and basically provides for "as appropriate" staffing and visits by operators. The needs and attendance of the boilers will be discussed with Ft. Myer operating personnel.

9 Vol 1, 16 Comment: Summer indoor conditions should be 78°F, 50% RH in accordance with Army regulations.

Response: Indoor conditions will be adjusted to be in accordance with TM 5-810-1.

10 Vol 1, 17 Comment: Phrase "as required by the gas company might be reworded to "during periods of curtailment".

Response: Agreed and will comply

11 Vol 1, 17 Comment: Be certain to use the most current fuel rates in the analysis and show how they were derived.

Response: Will comply.

12 Vol 1, 19 Comment: Economic life and discount factors should be in accordance with the most recent (14 Nov 92) ECIP criteria.

Response: As noted in comment 18 below, the values used are correct. The document reference in the body of the text needs to be corrected and will be.

13 Vol 1, 33 Comment: Assumption for air conditioning at Bldg. 403 should be verified with just a phone call.

Response: Initially, calls were made but the answers were still unclear. We will make a limited survey to determine the operation of the equipment installed.

14 Vol 1, 35 Comment: Paragraph "Other Steam Uses" at Bldg. 404 should be expanded to include required steam pressure, use of booster heaters at dishwashers, and if steam comes in contact with food.

Response: Will comply.

15 Vol 1, 36 Comment: If there is no kitchen in Bldg. 405 then domestic hot water flow is probably less than assumed. Please verify.

Response: Agreed. This will be verified and the calculations adjusted as required.

16 General Comment: Narrative needs discussion of the maintenance aspects of the existing and proposed systems.

Response: Will comply.

17 General Comment: The following comments apply to Vol II.

Response: - - - -

18 Summary Sheets Comment: LCCA Summary Sheets are in accordance with the latest ECIP Guidance. See comment 12 above.

Response: See comment 12.

19 Vol 2, 1/4 Comment: Provide more details regarding materials, labor and contract costs for existing Operation, Maintenance and Repair costs.

Response: Will comply.

20 Savings Comment:

a. Provide backup for labor and overhead rates on sheets 2 and 3 of 9. Are these DEH employees or contractors.

b. Sheet 3 of 9, refer to comment 8; the periodic monitoring may be on the order of once per day for some boilers, although the DEH has some latitude in this matter.

c. Sheet 4 of 9, maintenance and repair of existing distribution system due to excessive downtime may be an opportunity to perform repairs but not as an added cost of operating the system.

d. Sheet 5 of 9, non-energy savings should be re-evaluated regarding using plant operators during the summer for system repairs, plant maintenance and for other tasks. The probable allocation of their time should be discussed with the DEH.

Responses:

a. Will comply. All applicable rates will be verified.

b. Anticipated operating schedules will be discussed with DEH personnel.

c. Upon review, this added cost will be deleted, however some time will be allocated to the operators for system repair during the summer.

d. In general, all non-energy savings figures will be closely re-evaluated and substantiated.

BALTIMORE DIST.. .T, CORPS OF ENGINEERS
ENGINEERING DIVISION
DESIGN BRANCH
CENAB-EN-D

TELECOPIER TRANSMISSION COVER SHEET

DATE: 27 July 93

PLEASE DELIVER THE FOLLOWING PAGES TO:

NAME: KEN

LOCATION: EAC

TELECOPIER NO: 703-978-7331

TELEPHONE NO: 703-978-0923

TRANSMISSION FROM:

NAME: James Hawk

TELEPHONE NO: 410-962-6704

TELECOPIER NO: (410) 962-3680

COMMENTS:

Re Volume II Comments

PAGE 1 OF 4 (INCLUDING THIS COVER SHEET)

IF THERE HAS BEEN ANY DIFFICULTY IN RECEIVING THIS TRANSMISSION, OR IF YOU DID NOT RECEIV. THE ENTIRE TRANSMISSION, PLEASE CALL THE SENDER AS SOON AS POSSIBLE.

MOBILE DISTRICT PROJECT REVIEW COMMENTS	Date: 27 Jul 93	Page 1 of 3
To: Jim Hawk Baltimore District, CENAB-EN-DF	From: (Section) CESAM-EN-CM (Reviewer) A. Battaglia 205-690-2618	
Project: FY92 Limited Energy Study Location: Fort Myer, VA	Year: FY-92	Line Item No.:
Type of Action: Interim Submittal Review		

ITEM NO.	DRAWING NO. OR PAR. NO.	COMMENTS	REVIEW ACTION
1.	General	Page 1 & 2 comments refer to Vol I; page 3 comments refer to Vol II.	
2.	General	Overall, the AE appears to be on the right track and is using a reasonable approach in the analysis of this study. There may be some room for improvement in some areas as noted below.	
3.	Contents	The Table of Contents should list the contents of both volumes.	
4.	Pg 1	3rd par: The study is not <u>funded</u> under the NECPA; it is not necessary to mention the funding. The rest of the paragraph is correct.	
5.	General	Define the symbol, "MBTU", as used in the report. Normally in EEAP studies MBTU means 1 million BTU; it looks as if you may be using it to represent 1 thousand BTU.	
6.	Pg 4	The table at the bottom of page 4 should have a title, and it should include the non-energy savings mentioned at the top of page 6.	
7.	Pg 5 & 6	The AE has put some thought into the analysis of the operations and maintenance costs of the existing and proposed systems. Some refinement of this analysis may be necessary. Recommend some additional discussion between AE and Fort Myers O&M personnel to reach a mutual understanding on: a. Current fuel prices b. Factors which could affect fuel prices, such as, interruptible and non-interrultible rates, backup fuels, environmental factors, etc. c. Tradeoffs on the cost of labor for operations and maintenance,	

PROJECT REVIEW COMMENTS (Continuation Sheet)			Date: 27 Jul 93	Page 2 of 3
Project and Location: FY92 Limited Energy Study Fort Myer, VA			FY-	Section: CESAM-EN-CM
ITEM NO.	DRAWING NO. OR PAR. NO.	COMMENTS		REVIEW ACTION
8.	General	Attached for your reference is an excerpt from Army Regulation 420-49, 22 Jun 90, "Heating, Energy Selection and Fuel Storage, Distribution, and Dispensing Systems". This AR provides guidance on staffing for boiler operations and should be applicable to the recommendations of Comment 7 above.		
9.	Pg 16	Summer indoor conditions should be 78°F, 50% RH in accordance with Army regulations.		
10.	Pg 17	5th line down from top of page: The phrase, "as required by the gas company" might be reworded to, "during periods of gas curtailment".		
11.	Pg 17	It's OK to discuss historical fuel rates, but be sure to use the most current value in your analysis; and show how it was derived.		
12.	Pg 19	Regarding Economic Life and Discount Factors, these will be dictated by the latest ECIP Guidance, which is dated 14 Nov 1992. The date, "Nov 88" mentioned in par 5.5, should be, "Oct 92". See Comment 18 below.		
13.	Pg 33	Regarding the assumption for air conditioning in Building 403: This assumption could be verified with a phone call.		
14.	Pg 35	Other Steam Uses (for the dining facility, B/404): This paragraph could use some more detail. What pressure steam is required? Are they using a booster water heater for the dishwasher? Does steam come into contact with food?		
15.	Pg 36	Building 406, Domestic Hot Water: If there is no kitchen in the Rec Center, the DHW flow is probably even less than assumed; please verify.		
16.	General	The narrative needs a discussion of the maintenance aspects of the existing and proposed systems.		

PROJECT REVIEW COMMENTS (Continuation Sheet)		Date: 27 Jul 93	Page 3 of 3
Project and Location: FY92 Limited Energy Study Fort Myer, VA		FY-	Section: CESAM-EN-CM
ITEM NO.	DRAWING NO. OR PAR. NO.	COMMENTS	REVIEW ACTION
17.	General	The following comments appply to Vol II.	
18.	LCCA Summary Sheets	The format and Uniform Present Worth Discount Factors used in the LCCA Summary Sheets are in accordance with the latest ECIP Guidance. See Comment 12 above for Vol I.	
19.	1 of 4	Costs of Existing Boiler Plant: Costs are shown for Plant Maintenance & Repair, Plant Operations Cost, and Steam Distribution Maintenance & Repair. Provide more detail with regard to materials, labor, and contract costs.	
20.	Savings	a. Sheets 2 & 3 of 9: Provide some backup for the labor rates and overhead rates shown. Are these for DEH employees or contractors? b. Sheet 3 of 9: Refer to Comment 8 above and to the excerpt from AR 420-49 furnished with the original set of comments dated 23 July. The periodic monitoring may be on the order of once per day for some of the proposed boilers, although the DEH has some latitude in this matter. c. Sheet 4 of 9: With regard to the additional maintenanace and repair of the existing steam distribution system due to excessive downtime. I would view this more as an opportunity to perform maintenance during the summer shutdown; so I would not treat it as a annual cost due to the proposed project. d. Sheet 5 of 9: The total non-energy savings of $373,500 may need some additional thought. When the central steam plant is shut down for the summer, the Army still has to pay the operators. Presumably, they will spend some of their time on O&M of the summer boilers; but the rest of the time they are available for other tasks, such as annual maintenance of the central plant and distribution system. This would appear to be a savings. As mentioned in Comment 7 above, this deserves some additonal discussion between the AE and the DEH.	

BALTIMORE DIS. .CT, CORPS OF ENGINEERS
ENGINEERING DIVISION
DESIGN BRANCH
CENAB-EN-D

TELECOPIER TRANSMISSION COVER SHEET

DATE: 26 July 93

PLEASE DELIVER THE FOLLOWING PAGES TO:

NAME: Ken

LOCATION: EAC

TELECOPIER NO: 703-978 7331

TELEPHONE NO: 703-978 0923

TRANSMISSION FROM:

NAME: J. Hawk

TELEPHONE NO: 410-962-6704

TELECOPIER NO: (410) 962-3680

COMMENTS:

Comments on Steam Study From Tony Battaglia

PAGE 1 OF 6 (INCLUDING THIS COVER SHEET)

IF THERE HAS BEEN ANY DIFFICULTY IN RECEIVING THIS TRANSMISSION, OR IF YOU DID NOT RECEIVE THE ENTIRE TRANSMISSION, PLEASE CALL THE SENDER AS SOON AS POSSIBLE.

MOBILE DISTRICT PROJECT REVIEW COMMENTS	Data: 23 Jul 93	Page 1 of 2
Jim Hawk Baltimore District, CENAB-EN-DF	From: (Section) CESAM-EN-CM (Reviewer) A. Battaglia 205-690-2618	
Project: FY92 Limited Energy Study Location: Fort Myer, VA	Year: FY-92	Line Item No.:
Type of Action: Interim Submittal Review		

ITEM NO.	DRAWING NO. OR PAR. NO.	COMMENTS	REVIEW ACTION
1.	General	To data, I have only received Vol I; hopefully I will receive and be able to review Vol II before comments are due. The following comments all pertain to Vol I.	
2.	General	Overall, the AE appears to be on the right track and is using a reasonable approach in the analysis of this study. There may be some room for improvement in some areas as noted below.	
3.	Contents	The Table of Contents should list the contents of both volumes.	
4.	Pg 1	3rd par: The study is not <u>funded</u> under the NECPA; it is not necessary to mention the funding. The rest of the paragraph is correct.	
5.	General	Define the symbol, "MBTU", as used in the report. Normally in EEAP studies MBTU means 1 million BTU; it looks as if you may be using it to represent 1 thousand BTU.	
6.	Pg 4	The table at the bottom of page 4 should have a title, and it should include the non-energy savings mentioned at the top of page 6.	
7.	Pg 5 & 6	The AE has put some thought into the analysis of the operations and maintenance costs of the existing and proposed systems. Some refinement of this analysis may be necessary. Recommmend some additional discussion between AE and Fort Myers O&M personnel to reach a mutual understanding on: a. Current fuel prices b. Factors which could affect fuel prices, such as, interruptible and non-interrultible rates, backup fuels, environmental factors, etc. c. Tradeoffs on the cost of labor for operations and maintenance,	

PROJECT REVIEW COMMENTS (Continuation Sheet)	Date: 23 Jul 93	Page 2 of 2
Project and Location: FY92 Limited Energy Study Fort Myer, VA	FY-	Section: CESAM-EN-CM

ITEM NO.	DRAWING NO. OR PAR. NO.	COMMENTS	REVIEW ACTION
8.	General	Attached for your reference is an excerpt from Army Regulation 420-49, 22 Jun 90, "Heating, Energy Selection and Fuel Storage, Distribution, and Dispensing Systems". This AR provides guidance on staffing for boiler operations and should be applicable to the recommendations of Comment 7 above.	
9.	Pg 16	Summer indoor conditions should be 78°F, 50% RH in accordance with Army regulations.	
10.	Pg 17	5th line down from top of page: The phrase, "as required by the gas company" might be reworded to, "during periods of gas curtailment".	
11.	Pg 17	It's OK to discuss historical fuel rates, but be clear about what values you will use in your analysis.	
12.	Pg 19	Regarding Economic Life and Discount Factors, these will be dictated by the latest ECIP Guidance, which is dated 14 Nov 1992.	
13.	Pg 33	Regarding the assumption for air conditioning in Building 403: This assumption could be verified with a phone call.	
14.	Pg 36	Other Steam Uses (for the dining facility, B/404): This paragraph could use some more detail. What pressure steam is required? Are they using a booster water heater for the dishwasher? Does steam come in contact with food?	
15.	Pg 38	Building 405, Domestic Hot Water: If there is no kitchen in the Rec Center, the DHW flow is probably even less than assumed; please verify.	
16.	General	The narrative needs a discussion of the maintenance aspects of the existing and proposed systems.	

Engineering Applications Consultants, P.C.

9004-B Crownwood Ct., Burke, Virginia 22015-1679; Phone (703) 978-0923; FAX: (703) 978-7331

FAX TRANSMITTAL

TO: Baltimore, COE	DATE: July 12, 1993
ATTN: Mr. Jim Hawk	RE: Summer Steam Shut Down Study
CLIENT PROJ. NO. DACA 31-89-C-0198	Fort Myer, Virginia
FAX NO. 410-962-0917	EAC PROJECT NO. 92002.00

Gentlemen:

We are sending you the following items consisting of 8 pages including cover sheet.

Hard copy to be sent: ☒ YES ☐ NO

DESCRIPTION

Our responses to comments to the Interim Submittal of the above referenced project.

REMARKS We have requested your guidance in responding to some of these comments. Please do not hesitate to call.

REPLY

If you do not receive the required number of pages, please contact sender at (703) 978-0923.

SENDER Ken Schram

92002\71293

Engineering
Applications
Consultants

A Professional
Corporation

9004-B Crownwood Ct.
Burke, Virginia 22015-1630
(703) 978-0923

July 7, 1993

Department of the Army
Baltimore District Corps of Engineers
31 Hopkins Plaza
Baltimore, Maryland 21201

Attention: Mr. James Hawk (CENAB-EN-D)
Room 1423

Re: Summer Steam Shut Down Study
Fort Myer, Virginia
A/E Contract No: DACA 31-89-C-0198
EAC Project No: 92002.00

Gentlemen:

The following are EAC's responses to the comments received regarding the interim submittal of the above referenced project. We have received comments from your office (CENAB-EN-D), office ANMY- ENO by Mr. Richard Rice, and office ANMY-ENE-D by Mr. Philip Stewart. These responses are open for discussion, and the respective reviewers should feel free to contact our office as necessary.

Sincerely yours,

ENGINEERING APPLICATIONS CONSULTANTS, P.C.

Kenneth Schram, P.E.
Project Manager

Enclosures

cc: cc, pm

92002\letters\70793

Responses to Review Comments:

Summer Steam Shut Down Study, Fort Myer, Virginia, Interim Submission

Comment No.	Location	Comment and Response

Code CENAB-EN-D

1 Vol 1, D1

Comment: The ECIP criteria mentioned has been superseded. Please obtain and incorporate latest known CEHSC-FU-M package dated Nov 1992.

Response: Paragraph 5.5 (page 19) states that UPW factors used were published in November 1988. In actuality, the ECIP calculations correctly state and use factors from NISTIR 85-3273-7, October 1992, which were included in the November 1992 ECIP criteria CEHSC-FU-M. This most recent package has been used in the study. Paragraph 5.5 will be corrected.

2 Vol 1, D1

Comment: Criteria list should include TM 5-802-1.

Response: Will comply as applicable to ECIP analyses.

3 Vol 1, 16

Comment: Indoor conditions should be in accordance with AEI Ch 11 and TM 5-810-1.

Response: Will comply. (Note that the criteria are identical to the currently referenced publication and will not effect the calculations.)

4 Vol 1, 19

Comment: UPW factors shall be in accordance with NIST Handbook 135 and the annual updates as required by CEHSC-FU-M dated Nov 1992.

Response: Please see response to Comment 1 above.

5 Vol 1, 21

Comment: Computer inputs should be carefully substantiated in case of future challenges.

Response: Will comply.

6 Vol 1, 22

Comment: Provide title for document ASHRAE 1989.

Response: Will clarify as "Chapter 23, Fundamentals, American Society of Heating, Refrigerating and Air-Conditioning Engineers, 1989."

7 Vol 1, 25

Comment: Consider reducing domestic hot water temperature to 120°F in all buildings with lavs, showers, and washers to minimize standby losses.

Response: The temperatures indicated in the "Building Narratives" section state the current operating conditions and/or ratings of the systems. It is agreed, however, that domestic hot water temperatures should be set lower in accordance with TM 5-810-5, Table 4-2, which provides for 110°F at the mentioned facilities. The calculations have provided for system operation at 2% capacity during "off hours" to cover standby losses in the various alternatives. This

percentage represents hot water storage at minimum acceptable temperatures.

8 Vol 1, 25 Comment: Consider reducing storage heater temperature to 120°F and using a small booster heater for the dishwasher to minimize standby losses. 190°F is too hot to deliver safely to lavatories.

Response: It is assumed that the reference of 190°F water is to Vol. 1, page 34, regarding the Dining Facility, Bldg. 404. As in response 6 above, the values reported indicate current equipment operation and/or ratings. The system currently supplies 158°F water; and this will be indicated. Also, the dishwashers include their own steam converters, as well as use steam directly. The calculations will be adjusted to use a lower water heating temperature differential of 120°F.

9 Vol 1, 3/10 Comment: Substantiate non-energy annual cost of 13 man hours per bldg for start-up, maintenance, etc.

Response: Will comply. (Note: it is assumed that the comment refers to Vol.2 "Engineering Calculations")

10 Vol 1, 35 Comment: Central steam with the potential of being treated cannot be used where it exists in the vicinity of food preparation. Please check and advise.

Response: Will comply, and include any adjustments to response 8 above.

11 Vol 1, 4/10 Comment: Follow the guidance in AR 420-49 concerning monitoring of boiler plants greater than 15 psig. Consider any extra shifts required to accomplish proper supervision by a roving stationary engineer.

Response: Will comply.

12 Vol 1, 41 Comment: Reconsider delivery of 180°F hot water to the child care center; there is a safety concern.

Response: Agreed. However, this building was not surveyed, per scope, and information to the contrary, as it would pertain to energy usage, was not available. We will verify the operation of this equipment.

13 Vol 1, 47 Comment: Discuss further the need for a specialized boiler for 110 psig.

Response: Will comply. Please refer to Volume 2, pages 1 and 2 of 31 "Local Boiler Selection". This text will be added to Volume 1.

14 Vol 1, 5/10 Comment: Substantiate costs of material and labor for the repair and maintenance of existing steam distribution system. Indicated if this is an avoided cost.

Response: Will comply. The cost savings may be greater than shown at this time.

15 Vol 1, 6 Comment: Discuss any sensitivity analyses which were performed to sift out the differences between alternative 1 and alternative 2.

Response: The discussion on page 6 citing operational and aesthetic benefits will be elaborated.

16 Vol 2, 1/40 Comment: Ascertain if the amount of steam input indicated by the manufacturer corresponds to a credit taken for the storage effect.

Response: Will comply.

17 Vol 2,13/21 Comment: Discuss the reasons behind selecting firebox boilers.

Response: Boiler selection follows discussion on pages 1 and 2 of 31 (Vol. 2), based on lowest initial cost. All costs will be verified and selections checked. In addition, criteria for demands between 1,000 Mbh and 5,000 Mbh will be expanded.

18 Vol 2, 2/2 Comment: Ascertain what portion of the makeup water is attributable to "point of use" and what portion is attributable to leaks.

Response: Please clarify intent of comment. (This value is not required for economic analysis, but may indicate the condition of the distribution piping. It should be noted that assumptions will have to be made, and also that items such as operation of relief valves will appear as leaks in the piping.)

19 Vol 2, 3/4 Comment: In the past WGL's calorific value for gas has been slightly higher than 1000 BTU/cu. ft. Please check and advise.

Response: A value of 1,031 BTU/cu. ft. per ECIP Guidelines will be used.

21 Vol 2,36/40 Comment: Check and advise on possibility that the converters have been reversed as far as duty is concerned. Justify the need for 180°F domestic hot water.

Response: This building was not scheduled for survey. Information provided has been taken from the construction drawings. As stated, none of the converters in Bldg. 452 are used for domestic water heating. This will be verified.

22 Spaces Comment: Explain why all space descriptions indicate schedule 1 for lighting and occupancy when several master schedules have been provided.

Response: Building 400 computations utilize all provided schedules (Admin, Music Studios, etc.). Building 525, Reheat Zone 20 should utilize schedule 2 "X-Ray" which is a 24 hour per day operation. This will be corrected. All other zones of Bldg. 525 are correctly input as using schedule 1.

23	General	Comment: Recommend that Cost Engineering be given an opportunity to review the submittal. Response: No A/E response.

Code ANMY-ENO:

1 --- Comment: (Not addressable.)

Response: None.

2 --- Comment: Do other alternatives exist to satisfy the requirement for small quantities of high pressure steam? Also, evaluate fuel costs of the existing plant. (Interruptible gas service is actually backed-up by lighter fuel oils, rather than residual oil, and thus is more expensive than the figures used in the study.)

Response: The alternative of using small capacity high pressure boilers in tandem with large low pressure boilers is addressed on page 47 of Volume 1. Fuel costs will be revised and incorporated as required.

3 --- Comment: (Not addressable. Summarizes comments by office ANMY-ENE-D.)

Response: See responses to office ANMY-ENE-D.

Code ANMY-ENE-D:

1a --- Comment: All 22 buildings covered under this study must be surveyed. Using only 11 buildings, as designated in the scope of work as "representative", cannot lead to an acceptable study.

Response: A/E response deferred to Government.

1b --- Comment: The study should be based on hot water demands per Army regulations, rather than capacities of the existing equipment. The existing equipment was oversized (for unknown reasons) and could result in a complete loss of any savings of a main plant summer shut down.

Response: It is agreed that TM 5-810-5 should be followed. If implemented, the savings calculated in the study would increase, although the proposed "summer" systems would not provide domestic hot water service equal to what the users currently receive. Because of the variance in hot water supply, it would be recommended that the existing equipment remain in some of the buildings, while, in other buildings, the systems should be replaced. We feel that these impacts should be discussed prior to continued work on the study.

2 --- Comment: Recommend this interim submission be rejected and another interim submission be provided that includes all 22 buildings and that implements the regulation required to empower energy conservation.

Response: As above, it is agreed that TM 5-810-5 should be followed. The extent of survey and the submittal level should be determined by the Government.

3 --- Comment: The final scope of work was significantly different from this office's original intent, including an alternative of installing smaller sized central steam system to handle the summer load. This office recommends that the study be cancelled or proper feedback be provided to commenters before the A-E proceeds with the project.

Response: Revisions to the scope should be defined by the Government. Viable alternatives should be analyzed and incorporated into the study.

4 --- Comment: Further review of the study will take place after discussion and resolution of the above items.

Response: The A/E is eager to provide Fort Myer with a meaningful document that will assist the base in meeting the required reductions in energy usage. At this point, a meeting of all concerned parties to determine the proper direction of the study appears to be necessary.

202-475-7571

Wednesday March 31, 1993 Page: 1

Summer steam shutdown Ft. Myer Interim submittal

File: C:\ARMS\public\FTMYER.DBF

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
1	D.RUHL	CENAB-EN-D	D-1	MEC	

The ECIP criteria mentioned has been superseded. The latest known CEHSC-FU-M criteria package is dated Nov 1992; please obtain and incorporate.

2 D.RUHL CENAB-EN-D D-1 MEC
Criteria list should include TM 5-802-1.

3 D.RUHL CENAB-EN-D VOL 1-16 MEC
Indoor conditions should be in accordance with AEI Ch 11 and TM 5-810-1.

4 D.RUHL CENAB-EN-D VOL 1-19 MEC
UPW factors shall be in accordance with NIST Handbook 135 and the annual updates as required by CEHSC-FU-M dated Nov 1992.

5 D.RUHL CENAB-EN-D VOL 1-21 MEC
Inputs to the computer simulation routine shall be carefully substantiated so that credibility can be maintained at a future date if challenges arise.

6 D.RUHL CENAB-EN-D VOL 1-22 MEC
Provide the title of the document indicated as ASHRAE 1989.

7 D.RUHL CENAB-EN-D VOL 1-25 MEC
Consider reducing the domestic hot water temperature to 120 deg F in all buildings with lavs, showers and washers to minimize standby losses.

8 D.RUHL CENAB-EN-D VOL 1-25 MEC
Consider reducing the storage heater temperature to 120 deg F and using a small booster heater for the dishwasher to minimize standby losses. 190 F deg. is too hot to deliver safely to lavatories.

9 D.RUHL CENAB-EN-D VOL 1-3/10 MEC
Substantiate the non-energy annual cost of 13 man hours per bldg for start-up, maintenance etc.

10 D.RUHL CENAB-EN-D VOL 1-35 MEC
Central steam with the potential of being treated can not be used where it exists in the vicinity of food preparation. Please check and advise.

Summer steam shutdown Ft. Myer Interim submittal

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
11	D.RUHL	CENAB-EN-D VOL 1	4/10	MEC	

Follow the guidance in AR 420-49 concerning monitoring of boiler plants greater than 15 psig. Consider any extra shifts required to accomplish proper supervision by a roving stationary engineer.

12 D.RUHL CENAB-EN-D VOL 1 41 MEC
Reconsider the delivery of 180 F deg hot water to the child care center; there is a safety concern.

13 D.RUHL CENAB-EN-D VOL 1 47 MEC
Discuss further the need for a specialized boiler for 110 psig.

14 D.RUHL CENAB-EN-D VOL 1 5/10 MEC
Substantiate costs of material and labor for the repair and maintenance of existing steam distribution system. Indicate if this is an avoided cost.

D.RUHL CENAB-EN-D VOL 1 6 MEC
Discuss any sensitivity analyses which were performed to sift out the differences between alternative 1 and alternative 2.

20 D.RUHL CENAB-EN-D VOL 2 MEC
Discuss the need to include water treatment stations and/or automatic blowdown with all of the local boiler installations.

16 D.RUHL CENAB-EN-D VOL 2 1/40 MEC
Ascertain if the amount of steam input indicated by the manufacturer corresponds to a credit taken for the storage effect.

17 D.RUHL CENAB-EN-D VOL 2 13/31 MEC
Discuss the reasons behind selecting firebox boilers.

18 D.RUHL CENAB-EN-D VOL 2 2/2 MEC
Ascertain what portion of the makeup water is attributable to "point of use" and what portion is attributable to leaks.

D.RUHL CENAB-EN-D VOL 2 3/4 MEC
the past WGL's calorific value for gas has been slightly higher than 0 BTU/cu ft. Please check and advise.

Summer steam shutdown Ft. Myer Interim submittal

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
21	D.RUHL	CENAB-EN-D	VOL 2-36/40	MEC	

Check and advise on the possibility that the convertors have been reversed as far as duty is concerned. Justify the need for 180 F deg domestic hot water.

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
22	D.RUHL	CENAB-EN-D	SPACES	MEC	PRINTOUT

Explain why all space descriptions indicate schedule 1 for lighting and occupancy when several master schedules have been provided.

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
23	D.RUHL	CENAB-EN-D	GENERAL	MEC	

Recommend that Cost Engineering be given an opportunity to review the submittal.

U.S. Army Engineer Activity, pital Area
Building 203, Fort Myer
Arlington, VA 22211-5050

US Army Corps
of Engineers

FACSIMILE TRANSMITTAL HEADER SHEET

DATE: 16 JUNE 93 PAGE 1 of 12

To: JIM HAWK

Office Symbol: CENAB-EN-DF

Fax Number: (410) 962 - ~~3378~~ 3680

Phone Number: (410) 962 - 3778

From: RICH RICE

Office Symbol: ANMY-ENO

Fax Number: (703) 696-6422

Phone Number: (703) 696-3824

Comments:

Precedence: (Circle One) Routine (Priority)

Releaser's Signature:

ANFM-ENO JUN 16 1993

MEMORANDUM FOR CENAB-EN-DF (ATTN: Jim Hawk)

SUBJECT: Interim Submittal, Summer Steam Shutdown, Fort Myer

1. The interim submittal does not provide the necessary information to make an intelligent decision on the feasibility or economics of not operating the central heat plant during the non heating season. Attached are comments that deal with the scope of study and issues that must be addressed if the study is to serve any useful purpose.

2. Additionally the AE has developed a proposal that requires the installation of high pressure boilers that must be attended, thus negating the savings possible by not manning the central plant during the off season. Certainly other alternatives exist to satisfy the requirement for small quantities of high pressure steam. The study is also flawed by using a rate for interruptable gas that is predicated upon using residual oil when the plant is now being driven to lighter fuels and thus higher rates for natural gas.

3. Again we appear to have a study where the AE went and did its own thing without really spending time with the operational parties involved. Thus the study does not adequately address the need nor provide the insight to reach a meaningful conclusion. If the government is to proceed with this undertaking the consultant must be instructed to redo the interim submittal taking into consideration all the facilities, data, and issues involved. If that cannot be done the study effort should be terminated as it will not provide a useful product as it now headed.

Encl

RICHARD B. RICE
Chief, Operations and
Maintenance Division

ANMY-ENE-D (410-10a) 18 MAY 1993

MEMORANDUM FOR ANMY-ENO

SUBJECT: Summer Steam Shutdown Study, Fort Myer

1. This office received the interim submission of the subject study for review. The study has two major problems that make it unacceptable.

a. The scope of work (copy enclosed) for the study included only 11 of the 22 buildings with a summer steam requirement. Any one of these buildings could require large amounts of steam during the summer. Any one of these buildings could pose difficult problems to provide separate steam and hot water sources. The first cost of the project and annual savings can not be determined unless all 22 buildings are surveyed.

b. The study was based on the size of existing steam to hot water heat exchangers, water heaters and other equipment. This equipment was oversized for the need because the regulations to prevent such oversizing were either not enforced or non-existant. A copy of a portion of one such regulation is enclosed. Each soldier is given a fixed amount of hot water to consume each day. The designer provides storage capacity to assure that the hot water will be available when needed and a burner only large enough to bring the average flow of hot water up to temperature. Without the regulation the designer will provide a much larger burner in order to keep the soldier happy. In fact, in the absence of regulation, the designer will oversize the equipment in order to make sure that the soldier is always happy without regard to energy conservation. Such oversized equipment can bring the summer steam load up to the winter load level and destroy any savings from shutting down the central steam plant in summer.

2. Recommend this interim submission be rejected and another interim submission be provided that includes all 22 buildings and that implements the regulation required to empower energy conservation.

3. This office provided comments on the scope of work in 1992. One of the comments was to study the possibility of installing smaller summer steam lines to provide the smaller summer steam requirements. This comment seems to have been ignored. Instead, the Government Project Manager deleted the requirement to survey all the buildings. The Government Project Manager did not inform this office of the change until it was too late. Recommend the study either be cancelled or proper feedback be provided to commenters before the A-E proceeds with the project.

4. The points of contact at this office is the undersigned. Call me at 703-696-6732 to let me know if my comments are going to be ignored. If you can convince me that my comments will be enforced then I review the study more carefully and provide more comments. If not, I would like to avoid wasting my time.

Philip P. Stewart

PHILIP P. STEWART
Chief, Mechanical/Electrical Section

2 Encls

Washington Gas

6801 Industrial Road
Springfield, Virginia 22151

January 11, 1993

Mr. Ken Schram
Engineering Applications Consultants, P.C.
9004-B Crownwood Court
Burke, Virginia 22015

Re: Ft. Myer - Summer Steam
Shut-Down Study

Dear Mr. Schram:

The following information is submitted per your request.

The total cost of the project is $122,471.50

Services	$ 25,455.00
Mains	71,192.50
Meters	22,600.00
Regulators	3,224.00

If there are any questions, please feel free to call me on (703) 750-5939.

Sincerely,

Bob Grisham

Bob Grisham
Sales Representative

Enclosures

Engineering Applications Consultants, P.C.

9004-B Crownwood Ct., Burke, Virginia 22015-1679; Phone (703) 978-0923; FAX: (703) 978-7331

FAX TRANSMITTAL

TO: Washington Gas, Northern Virginia

ATTN: Mr. Matt Ryan

CLIENT PROJ. NO. DACA 31-89-C-0198

FAX NO. (703) 750-7691

DATE: December 15, 1992

RE: Summer Steam Shut Down Study
Ft. Myer, Virginia

EAC PROJECT NO. 92002.00

Gentlemen:

We are sending you the following items consisting of 2 pages including cover sheet.

Hard copy to be sent: ☐ YES ☒ NO

DESCRIPTION

Anticipated demands and connected equipment capacities for various buildings in MBH (1 MBH = 1,000 Btu/hr).

REMARKS Work for most buildings should be lateral and meter, however Building 525 (Rader Clinic) seems to be remote from the existing mains.

I hope the data is complete.

Thank you for your assistance.

REPLY

If you do not receive the required number of pages, please contact sender at (703) 978-0923.

SENDER Ken Schram

eacforms\faxtran

Summer Steam Peak Demands (Scheme 2)

Building Number	Utilization	Domestic Hot Water Heating Heat (MBH)	Steam (psig)	Steam (lbs/hr)	Other Requirements Heat (MBH)	Steam (psig)	Steam (lbs/hr)	Total Demand (MBH)	Connected Equipment Size (MBH) (TYPE
246	Enlisted Barracks	1,950.0	10	2,048	108.8	85	121	2,059	3,500 (Boiler
247	Enlisted Barracks	1,985.5	11	2,090	100.4	85	112	2,086	3,500 (")
248	Enlisted Barracks	1,642.0	11	1,728	209.2	85	232	1,851	2,500 (")
249	Enlisted Barracks	183.3	8	192	0.0	---	0	183	270 (Water H
250	Enlisted Barracks	2,245.2	8	2,351	66.9	85	74	2,312	3,500 (Boiler)
251	Enlisted Barracks	720.8	8	755	100.4	85	112	821	1,500 (Boiler)
400	Band	300.0	8	315	467.0	8	486	767	1,392 (")
402	Enlisted Barracks	2,812.0	20	2,992	0.0	---	0	2,812	4,713 (")
403	Enlisted Barracks	3,700.0	20	3,936	0.0	---	0	3,700	6,921 (")
* 404	Dining Facility	5,531.0	10	5,822	2,178.2	15	2,305	7,709	13,843 (")
405	Recreation Center	501.0	10	528	0.0	---	0	501	650 (Water H
406	Enlisted Barracks	3,700.0	20	3,936	0.0	---	0	3,700	6,921 (Boiler
407	NCO Club	835.0	10	879	0.0	---	0	835	1,000 (Water
410	Enlisted Barracks	990.0	10	1,042	0.0	---	0	990	1,250 ("
411	Bowling Center	91.5	7	96	0.0	---	0	92	140 ("
416	Enlisted Barracks	3,700.0	20	3,936	0.0	---	0	3,700	6,921 (Boile
* 423	Commissary	398.9	10	419	0.0	---	0	399	600 (Water
450	Main Exchange	160.0	10	168	0.0	---	0	160	300 ("
452	PX Service Station	0.0	---	0	0.0	---	0	0	0
* 469	Child Care Center	775.8	2	803	0.0	---	0	776	800 (Water
* 501	Tencza Terrace	1,950.0	15	2,064	0.0	---	0	1,950	3,197 (Boile
525	Rader Clinic	1,350.0	8	1,414	1,272.7	8	1,326	2,623	3,854 (Boile
							Grand Total =	40,026	

(Wash. Gas Co. #

model AL-1400
→(#112453)
3", 1400 CFH @ ½" ΔP
3000 CFH @ 2" ΔP

model AL-175
(#544714)
¼" → ¾", 175 CFH
@ ½" ΔP

2" → 3" (#411383)
60-A-1500 CFH

* Indicates an existing gas service capacity (if known by our office) is indicated.

Engineering
Applications
Consultants

A Professional
Corporation

9004-B Crownwood Ct.
Burke, Virginia 22015-1630
(703) 978-0923

December 9, 1992

Department of the Army
Baltimore District Corps of Engineers
31 Hopkins Plaza
Baltimore, Maryland 21201

Attention: Mr. James Hawk (CENABEN-D)
Room 1423

Re: Summer Steam Shut Down Study
Fort Myer, Virginia
A/E Contract No: DACA 31-89-C-0198
EAC Project No: 92002.00

Gentlemen:

This letter is to advise you that through EAC's site survey and reviews of the construction documents, certain deviations from the work outlined in the scope have been noted. The deviations are as follows:

1. Building 400 "Band" was found to use summer steam not only for domestic water heating, but also as reheat for the Administrative section variable air volume system and for humidity control in the Major Studio and Stage area.

2. Building 402 "Enlisted Barracks" was found to not use summer steam for reheat purposes. The building uses summer steam only for domestic water heating.

3. The construction documents for Building 452 "PX Service Station" indicated that the domestic water heating requirement is satisfied by an electric storage tank type heater. Though the building has two steam-to-hot water converters, both are used for winter heating demands. Per the original design, one converter serves the heating coil in the air handling unit using 140°F water, and the other serves the garage bay unit heaters using 180°F water. It is possible that the converter serving the air handling unit could be misconstrued as a domestic water heater based on the leaving water temperature. The building was not scheduled for survey in the scope of work.

4. Buildings 404 "Dining Facility" and 450 "Main Exchange" both have duct mounted hydronic heating coils, referred to as reheat coils on the original construction drawings, at various locations. These coils, however, are "locked out" from summer operation by the air conditioning control systems and do not provide reheat service. Their operation is limited to heating service in the winter season.

5. Building 525 "Rader Clinic" was found to use summer steam extensively for reheating purposes, in addition to domestic water heating. The air conditioning system uses 76 hydronic reheat coils located throughout the

building to provide temperature control to all occupied spaces in the two-story, 55,000 square foot facility.

The proposed changes in the work load resulting from the above deviations are as follows:

Item 1 will result in an increase in effort because Building 400 now requires that a computer model of the air conditioning systems be performed to determine the energy uses.

Item 2 will result in a reduction in effort because Building 402 no longer requires that a computer model of any reheat type air conditioning systems be performed to determine energy uses. It is proposed that the effort required by Item 1 will be partially offset by the reduction in effort of Item 2, and thus there will be a net additional work requirement of 24 manhours.

Item 3 will result in a some increase in effort to field verify that both converters are used for air system heating during the winter season only. It is proposed that this work be performed at no additional cost.

Item 4 will not result in any change in effort from the scope of work.

Item 5 will result in an increase in effort because Building 525 now requires that additional calculations along with a computer model of the entire air conditioning system be performed to determine the energy uses. It is anticipated that this work can be performed with an additional effort of 16 manhours of field survey, 60 manhours of calculations and modelling, and 8 manhours of report writing and wordprocessing.

Sincerely,

ENGINEERING APPLICATIONS CONSULTANTS, P.C.

Kenneth S M Schram

Kenneth Schram
Project Engineer

KS:cag

cc: cc, pm,
Mr. Ralph Gibson

Engineering Applications Consultants, P.C.

9004-B Crownwood Ct., Burke, Virginia 22015-1679; Phone (703) 978-0923; FAX: (703) 978-7331

MEETING REPORT

Project: Summer Steam Shut Down Study, Fort Myer, Virginia

Contract (Client Project) No.: DACA 31-89-C-0198 EAC Project No.: 92002.00

Place: EAC Date: 11-24-92

Purpose: Discuss project scope of work and progress

Person(s) Present	Code/Designation	Firm/Agency	Telephone
Mr. Jim Hawk	Project Manager	Balt. COE	410-962-3778
Mr. Ken Schram	Engineer	EAC	703-978-0923

1. The meeting commenced at 10:00 am.

2. The notice to proceed for the project is November 1, 1992. The submittal dates are the same time period as those used in the Fort Belvoir and Fort McNair studies.

   The scheduled submission dates used in Annex 2 of the original contract for Fort Myer are:

NTP to Interim Submittal Report	- 122 days
Interim Review Conference	- 163 days
Interim Report Approval	- 164 days
Prefinal Submittal	- 250 days
Prefinal Review Conference	- 293 days
Prefinal Approval	- 294 days
Final Submittal	- 324 days

   Note that the current progress of the study indicates a substantial acceleration in the schedule is possible.

3. The scope of work was reviewed:

   a. Through EAC's site survey and reviews of the construction documents, certain deviations from the work outlined in the scope were noted. The affected buildings are: 400, 402, 452, and 525. Additionally, buildings 404 and 450 were noted as potential "reheat coil" steam use situations, however currently, the air conditioning controls provide for all steam valves to be closed during cooling work. Detailed descriptions of these changes will be documented separately, along with any change in study effort and cost.

   b. The effect of limited survey on the accuracy of the study was discussed. Because many of the buildings surveyed were found to have changes in the method of domestic hot water heating (from the latest available drawings), there are consequent changes in steam requirements. The change from a large-storage/low heat system to a zero-storage/high heat (instantaneous) system can increase the hourly steam demand by 400% or more; though recognized that over a season, the total heat used should be equal. This affects initial investment costs and therefore rates of return on investment.

      It was agreed that conservative engineering judgements can be made as to the future requirements of the "unknown" buildings with possible conversions to instantaneous heaters recognized, however the work outlined does not preclude the need to verify the type of system currently in each building.

c. Wherever en as practical from an engine ng and construction standpoint, EAC shall include alternatives such as joint usage of one boiler between adjacent, low demand, facilities; continued use of existing steam distribution piping for summer use; etc.

d. The interim submission need only to be presented in a simple and inexpensive manner. Three ring binders are not necessary. Cardstock covers with some suitable binder will be sufficient.

e. Mr. Hawk stressed the importance of stating, in the text of the study, which specific "scope of work" item the particular section is addressing. He added that this labeling provides for a more effective review and also assists in marking contract performance requirements.

4. EAC shall send a letter to Mr. Hawk indicating the existing conditions and steam usage characteristics of the buildings that differ from the description in the detailed scope of work correspondence of July 21, 1992. The letter shall indicate the building number and describe the changes. Included in this letter shall be our recommendations on what changes should be made to the report/calculations, and a cost/effort estimate for the changes.

   A formal submittal schedule shall also be included in this letter.

5. Mr. Hawk shall provide EAC with current labor rates for steam system operation and maintenance personnel at Fort Myer. The figures provided will be composite values of salaries and all associated overhead expenses.

6. Mr. Hawk plans to have a project coordination meeting every month to monitor progress. At each meeting, EAC shall provide figures for percent completion, and the portion of the contract spent to date.

7. The meeting was adjourned at 11:30 am.

Prepared by K. Schram

Engineering Applications Consultants, P.C.

9004-B Crownwood Ct., Burke, Virginia 22015-1679; Phone (703) 978-0923; FAX: (703) 978-7331

FAX TRANSMITTAL

TO: Cummins-Wagner Co. Inc.	DATE: 19 NOV 92
ATTN: Ruta	RE: Various Bell & Gossett "SU" Exchangers at Ft. Myer, VA
CLIENT PROJ. NO. - - -	
FAX NO. 1-301-490-7156	EAC PROJECT NO. 92002.00

Gentlemen:

We are sending you the following items consisting of 3 pages including cover sheet.

Hard copy to be sent: ☐ YES ☒ NO

DESCRIPTION

DATA REQUESTED FOR 5 BELL & GOSSETT STEAM TO HOT WATER CONVERTERS. (EXISTING)

REMARKS
- 1) and 2) from Computer selection
- 3) and 5) from Factory
- 4) from your files or Factory

Please respond as soon as possible as my study is due in 1 week, even if it is "piece-by-piece." Your help is greatly appreciated.

REPLY

Thanks,

Ken

If you do not receive the required number of pages, please contact sender at (703) 978-0923.

SENDER KEN SCHRAM

eacforms\faxtran

Engineering
Applications
Consultants

ENGINEERING ANALYSIS

Sheet 1 of 2

STEAM CAPACITIES OF EXISTING EXCHANGERS

By: K. SCHRAM

Project: SUMMER STEAM SHUT DOWN STUDY, FT. MYER Date: 19 NOV 92

Contract No.: DACA 31-89-C-0198 Project No.: 92002.00

---

1) BLDG. 247: @ FT. MYER

MODEL IS B&G SU-66-4
USE 11 PSIG STEAM
ENTERING WATER = 40°F
LEAVING WATER = 130°F
WATER FLOW = 40 GPM

WHAT IS STEAM FLOW (LB/HR)?

---

2) BLDG. 248: @ FT. MYER

MODEL IS B&G SU-87-2
11 PSIG STEAM
EWT = 40°F LWT = 130°F
WATER FLOW = 80 GPM

WHAT IS STEAM FLOW (LB/HR)?

---

3) BLDG. 250: @ FT. MYER

BELL & GOSSETT (1988)
ID#: 5-260-06-060-002
SERIAL#: 88P8098540

WHAT ARE STEAM AND WATER FLOW RATES?

Engineering
Applications
Consultants

ENGINEERING ANALYSIS

Sheet 2 of 2

STEAM CAPACITIES OF EXISTING EXCHANGERS

By: K. SCHRAM

Project: SUMMER STEAM SHUT DOWN STUDY, FT. MYER Date: 19 NOV 92

Contract No.: DACA 31-89-C-0198 Project No.: 92002.00

---

4) BLDG. 404
@ FT. MYER

CUMMINS - WAGNER
SERIAL #463

DATA FROM THE SAME CONVERTER

BELL & GOSSETT (1989)
SERIAL #: 89R79324-01

WHAT ARE STEAM AND WATER FLOW RATES?

---

5) BLDG. 423
@ FT. MYER

BELL & GOSSETT (1980)
FACTORY #: 125665
MODEL: SU-62-2

WHAT ARE STEAM AND WATER FLOW RATES?

CUMMINS–WAGNER FAX

PH. (301) 490–9007 FAX (301) 490–7156
10901 PUMP HOUSE ROAD, ANNAPOLIS JUNCTION, MD. 20701
BALTO.: (410) 792-4230 WASH. D.C. & NO. VA.: (301) 953–9370
"100% EMPLOYEE OWNED"

DATE: 11/25/92 PAGE 1 OF ____

ATTN: Ken Schram FAX NO.: (703) 978-7331

COMPANY: Engineering Applications, Inc.

FROM: Richard Forrest

MESSAGE:

Ken, please find information as far as I can decifer with regard to the units you sent me. Any questions, please call.

Thanks, Rich

Customer:
Job Name: Fort Myer

Proposal No.:
Date: 11/24/92

Model: QSU 6 6-4

Sq.ft. Surface: 26.8

* * * * * * * * * * PERFORMANCE DATA * * * * * * * * * *

	Tube Side	Shell Side	
Fluid Circulated:	Water	Steam	
Total Flow:	40.0	4.4	GPM
Total Flow:	19876.9	→ 2089.7	PPH
Specific Gravity:	0.99	0.96	
Specific Heat:	1.00	1.00	BTU/lb-°F
Viscosity:	0.77	0.27	Centipoise
Thermal Conductivity:	0.365	0.382	BTU/hr-°F-ft²/ft
Inlet Temperature:	40.0	241.0	°F
Outlet Temperature:	140.0	241.0	°F
Steam Pressure:		11.0	PSIG
Velocity:	2.9		Ft/sec
Pressure Drop:	0.3		PSI
Pressure Drop:	0.8		Feet Water
Nozzle Size:	2.00 NPT		Inches
Steam Inlet Nozzle Size:		4.00 Flng	Inches
Condensate Nozzle Size:		1.25 NPT	Inches

* * * * * * * HEAT TRANSFER CHARACTERISTICS * * * * * * * *

Heat Load:	1986530	BTU/hr
LMTD:	145.28	°F
LMTD Correction Factor:	1.00	
Shellside Film Coefficient:	1842.1	BTU/hr-ft²-°F
Tubeside Film Coefficient:	766.4	BTU/hr-ft²-°F
Total Fouling - Requested:	+0.00025	Ft²-°F-hr/BTU
Total Fouling - Actual:	+0.00022	Ft²-°F-hr/BTU
Overall "U" Value:	503	BTU/hr-ft²-°F
Surface Area - Required:	27.2	Ft²

* * * * * * * * * * * UNIT DATA * * * * * * * * * * *

Design Pressure:	150.0	150.0	PSIG
Design Temperature:	375.0	375.0	°F

Front Head: Cast Iron (Bonnet)
Tie Rods/Spacers: Steel
Gasket Material: Compressed Fiber
Tubesheet: Steel
Tubes: 3/4" O.D. Copper
Tubewall TK: 0.035"

Baffles: Steel
Shell: Steel

Tube Gauge: 20.0 B.W.G.

CODE: ASME Sec. VIII, Div. 1

Remarks: Building 247

Customer:
Job Name: Fort Myer

Proposal No.:
Date: 11/24/92

Model: QSU 8 7-2

Sq.ft. Surface: 58.2

* * * * * * * * * * PERFORMANCE DATA * * * * * * * * * *

	Tube Side	Shell Side	
Fluid Circulated:	Water	Steam	
Total Flow:	80.0	8.7	GPM
Total Flow:	39753.8	→ 4179.3	PPH
Specific Gravity:	0.99	0.96	
Specific Heat:	1.00	1.00	BTU/lb-°F
Viscosity:	0.77	0.28	Centipoise
Thermal Conductivity:	0.365	0.381	BTU/hr-°F-ft²/ft
Inlet Temperature:	40.0	241.0	°F
Outlet Temperature:	140.0	241.0	°F
Steam Pressure:		11.0	PSIG
Velocity:	3.2		Ft/sec
Pressure Drop:	0.5		PSI
Pressure Drop:	1.1		Feet Water
Nozzle Size:	3.00 NPT		Inches
Steam Inlet Nozzle Size:		6.00 Flng	Inches
Condensate Nozzle Size:		1.50 NPT	Inches

* * * * * * * * HEAT TRANSFER CHARACTERISTICS * * * * * * * *

Heat Load:	3973059	BTU/hr
LMTD:	145.28	°F
LMTD Correction Factor:	1.00	
Shellside Film Coefficient:	1755.9	BTU/hr-ft²-°F
Tubeside Film Coefficient:	821.6	BTU/hr-ft²-°F
Total Fouling - Requested:	+0.00025	Ft²-°F-hr/BTU
Total Fouling - Actual:	+0.00044	Ft²-°F-hr/BTU
Overall "U" Value:	517	BTU/hr-ft²-°F
Surface Area - Required:	52.9	Ft²

* * * * * * * * * * * * UNIT DATA * * * * * * * * * * *

Design Pressure:	150.0	150.0	PSIG
Design Temperature:	375.0	375.0	°F

Front Head: Cast Iron (Bonnet)
Tie Rods/Spacers: Steel
Gasket Material: Compressed Fiber
Tubesheet: Steel
Tubes: 3/4" O.D. Copper
Tubewall TK: 0.035"

Baffles: Steel
Shell: Steel

Tube Gauge: 20.0 B.W.G.

CODE: ASME Sec. VIII, Div. 1

Remarks: Building 248

Customer:

Proposal No.:

Job Name: Fort Myer

Date: 11/24/92

Model: QSU 6 5-4

Sq.ft. Surface: 22.1

* * * * * * * * * * PERFORMANCE DATA * * * * * * * * * *

	Tube Side	Shell Side	
Fluid Circulated:	Water	Steam	
Total Flow:	45.0	4.9	GPM
Total Flow:	22361.5	→ 2350.9	PPH
Specific Gravity:	0.99	0.96	
Specific Heat:	1.00	1.00	BTU/lb-°F
Viscosity:	0.77	0.27	Centipoise
Thermal Conductivity:	0.365	0.382	BTU/hr-°F-ft²/ft
Inlet Temperature:	40.0	241.0	°F
Outlet Temperature:	140.0	241.0	°F
Steam Pressure:		11.0	PSIG
Velocity:	6.6		Ft/sec
Pressure Drop:	2.3		PSI
Pressure Drop:	5.4		Feet Water
Nozzle Size:	1.50 NPT		Inches
Steam Inlet Nozzle Size:		5.00 Flng	Inches
Condensate Nozzle Size:		1.25 NPT	Inches

* * * * * * * HEAT TRANSFER CHARACTERISTICS * * * * * * * *

Heat Load:	2234846	BTU/hr
LMTD:	145.28	°F
LMTD Correction Factor:	1.00	
Shellside Film Coefficient:	1624.3	BTU/hr-ft²-°F
Tubeside Film Coefficient:	1466.1	BTU/hr-ft²-°F
Total Fouling - Requested:	+0.00025	Ft²-°F-hr/BTU
Total Fouling - Actual:	+0.00019	Ft²-°F-hr/BTU
Overall "U" Value:	668	BTU/hr-ft²-°F
Surface Area - Required:	23.0	Ft²

* * * * * * * * * * * UNIT DATA * * * * * * * * * * *

Design Pressure:	150.0	150.0	PSIG
Design Temperature:	375.0	375.0	°F

Front Head: Cast Iron (Bonnet)
Baffles: Steel
Tie Rods/Spacers: Steel
Shell: Steel
Gasket Material: Compressed Fiber
Tubesheet: Steel
Tubes: 3/4" O.D. Copper
Tube Gauge: 20.0 B.W.G.
Tubewall TK: 0.035"

CODE: ASME Sec. VIII, Div. 1

Remarks: Building 250

Customer:
Job Name: Fort Myer

Proposal No.:
Date: 11/24/92

Model: SU10 8-4

Sq.ft. Surface: 116.5

* * * * * * * * * * PERFORMANCE DATA * * * * * * * * * *

	Tube Side	Shell Side	
Fluid Circulated:	Water	Steam	
Total Flow:	100.0	10.9	GPM
Total Flow:	49692.2	→ 5224.2	PPH
Specific Gravity:	0.99	0.96	
Specific Heat:	1.00	1.00	BTU/lb-°F
Viscosity:	0.77	0.26	Centipoise
Thermal Conductivity:	0.365	0.382	BTU/hr-°F-ft²/ft
Inlet Temperature:	40.0	241.0	°F
Outlet Temperature:	140.0	241.0	°F
Steam Pressure:		11.0	PSIG
Velocity:	2.3		Ft/sec
Pressure Drop:	0.3		PSI
Pressure Drop:	0.7		Feet Water
Nozzle Size:	4.00 NPT		Inches
Steam Inlet Nozzle Size:		6.00 Flng	Inches
Condensate Nozzle Size:		2.00 NPT	Inches

* * * * * * * HEAT TRANSFER CHARACTERISTICS * * * * * * * *

Heat Load:	4966324	BTU/hr
LMTD:	145.28	°F
LMTD Correction Factor:	1.00	
Shellside Film Coefficient:	1945.4	BTU/hr-ft²-°F
Tubeside Film Coefficient:	634.3	BTU/hr-ft²-°F
Total Fouling - Requested:	+0.00025	Ft²-°F-hr/BTU
Total Fouling - Actual:	+0.00145	Ft²-°F-hr/BTU
Overall "U" Value:	453	BTU/hr-ft²-°F
Surface Area - Required:	75.4	Ft²

* * * * * * * * * * * UNIT DATA * * * * * * * * * * *

Design Pressure:	125.0	150.0	PSIG
Design Temperature:	375.0	375.0	°F

Front Head: Cast Iron (Bonnet)
Tie Rods/Spacers: Steel
Gasket Material: Compressed Fiber
Tubesheet: Steel
Tubes: 3/4" O.D. Copper
Tubewall TK: 0.035"

Baffles: Steel
Shell: Steel

Tube Gauge: 20.0 B.W.G.

CODE: ASME Sec. VIII, Div. 1

Remarks: Building 404

Customer:
Job Name: Fort Myer

Proposal No.:
Date: 11/24/92

Model: QSU 6 2-2

Sq.ft. Surface: 6.0

* * * * * * * * * * PERFORMANCE DATA * * * * * * * * * *

	Tube Side	Shell Side	
Fluid Circulated:	Water	Steam	
Total Flow:	10.0	0.9	GPM
Total Flow:	4978.9	→ 419.1	PPH
Specific Gravity:	1.00	0.95	
Specific Heat:	1.00	1.00	BTU/lb-°F
Viscosity:	0.86	0.26	Centipoise
Thermal Conductivity:	0.363	0.382	BTU/hr-°F-ft²/ft
Inlet Temperature:	40.0	241.0	°F
Outlet Temperature:	120.0	241.0	°F
Steam Pressure:		11.0	PSIG
Velocity:	2.9		Ft/sec
Pressure Drop:	0.3		PSI
Pressure Drop:	0.8		Feet Water
Nozzle Size:	0.75 NPT		Inches
Steam Inlet Nozzle Size:		2.00 NPT	Inches
Condensate Nozzle Size:		0.50 NPT	Inches

* * * * * * * HEAT TRANSFER CHARACTERISTICS * * * * * * * *

Heat Load:	398452	BTU/hr
LMTD:	157.60	°F
LMTD Correction Factor:	1.00	
Shellside Film Coefficient:	2050.1	BTU/hr-ft²-°F
Tubeside Film Coefficient:	731.1	BTU/hr-ft²-°F
Total Fouling - Requested:	+0.00025	Ft²-°F-hr/BTU
Total Fouling - Actual:	+0.00063	Ft²-°F-hr/BTU
Overall "U" Value:	502	BTU/hr-ft²-°F
Surface Area - Required:	5.0	Ft²

* * * * * * * * * * UNIT DATA * * * * * * * * * *

Design Pressure:	150.0	150.0	PSIG
Design Temperature:	375.0	375.0	°F

Front Head: Cast Iron (Bonnet)
Tie Rods/Spacers: Steel
Gasket Material: Compressed Fiber
Tubesheet: Steel
Tubes: 3/4" O.D. Copper
Tubewall TK: 0.035"

Baffles: Steel
Shell: Steel

Tube Gauge: 20.0 B.W.G.

CODE: ASME Sec. VIII, Div. 1

Remarks: Building 423

Engineering Applications Consultants, P.C.

9004-B Crownwood Ct., Burke, Virginia 22015-1679; Phone (703) 978-0923; FAX: (703) 978-7331

MEMORANDUM OF RECORD

Project: Summer Steam Shut Down Study, Fort Myer, Virginia

Contract (Client Project) No.: DACA 31-89-C-0198 EAC Project No.: 92002.00

13NOV92 11:05am

Discussion with Mr. John Parker (Maintenance):

Q: The dining facility has its own chiller and there are reheat coils in the perimeter ductwork. Do they run the chiller "out of season" on warmer winter days and possibly invoke reheat?

A: → No, in fact, they (the Dining Facility) need permission to operate the chiller. It never happens.

Q: At the Main Exchange the VAV system serving the front section — Snack Bar, Dry Cleaning, Florist, etc. — has "reheat" coils on each VAV box. The original construction drawings call for a "lock-out" on these heating coils when there is cooling work being done at the Air Handling Unit! Is this still the present operation?

A: → Yes, there is no flow when the chiller and chilled water pumps are operating. Therefore this is not a "reheat" system.

By K. Schram

Engineering Applications Consultants, P.C.

9004-B Crownwood Ct., Burke, Virginia 22015-1679; Phone (703) 978-0923; FAX: (703) 978-7331

TELEPHONE CONVERSATION SUMMARY

Project: Summer Steam Shut Down Study, Fort Myer, Virginia

Contract (Client Project) No.: DACA 31-89-C-0198 EAC Project No.: 92002.00

From: Ken Schram Telephone: 703-978-0923 Date: 11/12/92

To: Ruth (Forenta, Inc.) Telephone: 615-586-5370 Time: 4:15 p.m.

The items discussed are as follows:

Mr. Schram called regarding the manufacturer's listing of steam requirements for the laundry presses in Building 246 Enlisted Barracks.

For the typical uniform (board) type of press, more information, such as a serial number, is required as Forenta manufactures over 80 types of presses. The serial number, along with a steam requirement, should be on an engraved plate located on the bottom surface of the lower board. If we (EAC) have a serial number only, Forenta will be able to tell us the rating of the machine. As a guess, the uniform press described should require 1.00 boiler horsepower of steam during normal pace, continuous use.

The specialty type press, Forenta model 33S as surveyed by EAC, requires 0.25 boiler horsepower during normal continuous use.

Prepared by Ken Schram

cc: cc, pm

92002\telefone\111192

Engineering Applications Consultants, P.C.

9004-B Crownwood Ct., Burke, Virginia 22015-1679; Phone (703) 978-0923; FAX: (703) 978-7331

MEMORANDUM OF RECORD

Project: Summer Steam Shut Down Study, Fort Myer, Virginia

Contract (Client Project) No.: DACA 31-89-C-0198 EAC Project No.: 92002.00

Office of Design and Engineering said that they do not keep shop drawings or manufacturer catalog cuts of any kind.

They referred ~~me~~ me to Mr. John Parker of Maintenance, when asked specifically for cooking equipment in Dining Facility.

Or, try at the Facility itself as a second recommendation.

by Ken Schram
22 October 1992

John Parker says his office does not keep those records either. He referred me to Mark Christopher in Plumbing Shop (BLDG. 307).

The Dining Facility does not keep any ~~of~~ of the shop drawings or manufacturer's catalog cuts on the cooking equipment.

by Ken Schram
23 October 1992

Engineering Applications Consultants, P.C.

9004-B Crownwood Ct., Burke, Virginia 22015-1679; Phone (703) 978-0923; FAX: (703) 978-7331

TELEPHONE CONVERSATION SUMMARY

Project: Summer Steam Shut Down Study, Fort Myer, Virginia

Contract (Client Project) No.: DACA 31-89-C-0198 EAC Project No.: 92002.00

From: Mr. Kenneth Schram Telephone: 703-978-0923 Date: 10/19/92

To: Mr. Bob Hennessee Telephone: 703-696-3811 Time: 10:00 am

Discussion:

Mr. Schram called requesting the following items pertaining to Ft. Myer utility rates and operating costs:

1) Natural gas usage and charges for buildings under this study for indication of which buildings currently have independent services and for baseline consumption data.

2) Fuel, maintenance, and operating costs for the Steam Plant (Bldg. 447) for the past two or three fiscal years.

3) Current and projected gas and electric utility rates and the rate structures used in billings.

Mr. Hennessee added that the Steam Plant was on interruptable gas service and that he may have some difficulty in determining oil usage during the couple "off" periods experienced during winters. Due to the interruptable service, the Steam Plant receives gas for approximately 31 cents per therm, while the rest of the customers pay an average of 65 cents per therm. Further, he said that Washington Gas owns the gas lines on the base and separately meters each building.

Mr. Hennessee said that the requested information should be ready for pick-up at his office on Wednesday, October 21, and that he will be available to answer questions. He is located in the basement of Building 203.

Mr. Hennessee noted that he will be out Thursday and Friday, but would leave the package ready if it is not picked-up on Wednesday.

cc: cc,pm

92002\telefone\101992

Engineering Applications Consultants, P.C.

9004-B Crownwood Ct., Burke, Virginia 22015-1679; Phone (703) 978-0923; FAX: (703) 978-7331

TELEPHONE CONVERSATION SUMMARY

Project: Summer Steam Shut Down Study, Fort Myer, Virginia

Contract (Client Project) No.: DACA 31-89-C-0198 EAC Project No.: 92002.00

From: Mr. Kenneth Schram Telephone: 703-978-0923 Date: 10/19/92

To: Ms. Caroline Abbott Telephone: 703-696-3249 Time: 11:00 am

Discussion:

Ms. Abbott was not in, but returned the call at 2:45pm.

Mr. Schram inquired about specific requirements for access to the various buildings to be surveyed for the referenced project.

Ms. Abbott said that there had been a change in policy and that the person to speak with to verify and/or arrange escorts for the survey work is Col. Kelly.

Ms. Abbott also noted that arrangements to sign-out keys to the various Mechanical rooms could be made through Mr. Parker.

Col. Kelly can be reached at 703-696-3597 or 703-696-3599.

cc: Ralph Gibson
cc, pm

92002\telefone\101992a

Engineering Applications Consultants, P.C.

9004-B Crownwood Ct., Burke, Virginia 22015-1679; Phone (703) 978-0923; FAX: (703) 978-7331

MEETING REPORT

Project: Summer Steam Shut Down Study, Fort Myer, Virginia

Contract (Client Project) No.: DACA 31-89-C-0198 EAC Project No.: 92002.00

Place: Conference Room, Bldg. 313, Ft. Myer Date: 30 September 1992

Purpose: Pre-work Conference to address administrative needs

Person(s) Present	Code/Designation	Firm/Agency	Telephone
Ralph W. Gibson	Energy Coordinator	ADCSEH	202-475-0919
Gary Keys	HVAC Foreman	Ft. Myer	703-696-3906
John Parker		ANMY	703-696-3187
Bob Hennessee	Operations/Maintenance	ANPW	703-696-3811
Virender Puri	President	EAC	703-978-0923
Kenneth Schram	Mechanical Engineer	EAC	703-978-0923

1. Meeting commenced at 1:15pm with personal introductions. Copies of the agenda for this meeting were distributed by Mr. Gibson.

2. Mr. Gibson and Mr. Puri provided a brief project description noting that this project is a study, and that there will be an interim (70%) submittal for review and comment, followed by the final submittal.

3. Ms. Caroline Abbott (not present) was identified as the administrative contact person for the base. Ms. Abbott shall be contacted to arrange all visits to the base and to coordinate building access and escort requirements. Ms. Abbott's office telephone number is 703-696-3249.

4. EAC shall provide Mr. Gibson with a list of all survey personnel (social security/date of birth) and vehicles (year/make/model/lic.number) for advance clearance. Mr. Gibson will then be able to provide EAC with a letter for access to the base listing purpose of visit and cleared personnel and vehicles.

5. At least a one-day advance notice shall be provided to Ms. Abbott for any visit to the base. Generally, buildings can be accessed between 7:00am and 3:00pm. Depending on the use, certain buildings will be available outside of these hours. Ms. Abbott may have a current listing of building use schedules.

6. Keys for all utility rooms can be signed-out on a daily basis from Bldg. 313, Maintenance. Room keys are available between 7:00am and 3:00pm.

7. No special parking requirements are anticipated. Parking is available across from the Mess Hall (Bldg. 404) and the Bowling Facility (Bldg. 411).

8. Mr. Hennessee was identified as the contact person for all utility rates, operation costs and maintenance records. He noted that natural gas service exists on the base, and that the distribution system is owned by Washington Gas. Each building being served has a meter and must pay between $8 and $60 per month, regardless of use for any particular month. Therefore, service for summer use in many buildings is readily available and part of the current arrangement.

9. Mr. Keys and Mr. Parker were identified as the contact persons for boiler plant operations and records. Boiler plant operation logs for fiscal years 1990, 1991 and 1992 were given to Mr. Schram. Plant logs shall be returned to Ft. Myer.

10. For general information, any of the persons identified above can be contacted, however all correspondence should be through Mr. Gibson initially.

11. In general, escorts should not be required. Escorts will most likely be required when surveying the Band building (Bldg. 400) and during picture taking. Ms. Abbott will verify.

12. Mr. Parker and Mr. Keys gave general operating steam pressures. Plant supply pressure is 120-125 psi, with intermediate pressure reductions to 30 psi, and final point-of-use pressures of 15 psi. At presses, however, 80 psi steam is provided. All steam-fired domestic water heaters are instantaneous type and use 15 psi steam.

13. Drawings are available from Mr. Charlie Chalfant (703-696-6730) or Mr. William Dickenson in Building 203, Design Branch.

14. The summer operating season begins on the 15th of May and ends on the 15th of October.

15. Mr. Gibson mentioned that the results of our study may impact another project which is providing a new central steam plant at the Pentagon. Depending on the results of our study, Ft. Myer may purchase steam from the new plant, instead of operating its own plant.

16. The meeting was adjourned at 2:05pm.

Prepared by Kenneth Schram KMS

cc: pm, cc

92002\meetings\093092

Engineering
Applications
Consultants

A Professional
Corporation

9004-B Crownwood Ct.
Burke, Virginia 22015-1630
(703) 978-0923

September 18, 1992

Department of the Army
Code ANEN-E, Building 42
Fort Lesley J. McNair
Washington, D.C. 20319-5050

Attention: Mr. Ralph Gibson
Energy Coordinator

Re: Summer Steam Shut Down Study
Fort Myer, Virginia
A/E Contract No: DACA 31-89-C-0198
EAC Project No: 92002.00

Gentlemen:

In order to initiate the referenced study, we are requesting the following information:

1. Contact persons for:

   Access and other general information
   Utilities
   Boiler Plant

2. Working hours and arrangements for access to the buildings.

3. Security and/or escort requirements.

4. Letter of authorization to perform the site surveys. Survey personnel will carry this letter as explaination of their purpose of visit while without escort.

5. Parking restrictions.

6. Procedures for taking pictures.

7. Current utility rate structures for:

   Gas service
   Electric service

8. Projected future utility rate structures for:

   Gas service
   Electric service

9. Account and contact person at Washington Gas, and authorization for releasing gas rates.

10. Account and contact person at Virginia Power, and authorization for releasing billing information and tapes for power consumption.

11. Boiler Plant (Bldg. 447) operation logs, fuel rates/consumption data, and maintenance costs for the past three years.

12. Steam supply pressures from Boiler Plant, and point of use pressures at each building.

13. Building profiles:

    Number of people that normally occupy each building.
    Maximum listed occupancy for each building.
    Daily schedules for use of each building.
    (24 hrs/day, nights, weekends only, etc.)
    Hot water demand schedules for each building.
    (2 hrs. in morning, 1 hr. at noon, etc.)

14. HVAC, Plumbing, and Electrical drawings of the following existing buildings:

    Bldg. 403 Enlisted Barracks
    Bldg. 404 Dining Facility
    Bldg. 405 Recreation Center
    Bldg. 406 Enlisted Barracks
    Bldg. 410 Enlisted Barracks
    Bldg. 416 Enlisted Barracks
    Bldg. 501 Tencza Terrace
    Bldg. 525 Rader Clinic

    Note: If any of the above are identified as "N.C.O. High Rise Apartments, then a duplicate set of drawings of this facility need not be included. Please inform us of the building number for this facility.

15. Facility site plans showing natural gas and steam utility distribution routes.

Thank you for your timely cooperation in this matter.

Sincerely,

ENGINEERING APPLICATIONS CONSULTANTS, P.C.

Kenneth Schram
Mechanical Engineer

KS:cag

cc: cc, pm

92002\letters\091892

cc

Engineering
Applications
Consultants

A Professional
Corporation

9004-B Crownwood Ct.
Burke, Virginia 22015-1630
(703) 978-0923

August 11, 1992

Department of the Army
Baltimore District Corps of Engineers
31 Hopkins Plaza
Baltimore, Maryland 21201

Attention: Mr. James Hawk
CENABEN-D, Room 1423

Re: Summer Steam Shut Down Study
Fort Myer, Virginia
A/E Contract No: DACA 31-89-C-0198
EAC Project No: 92002.00

Gentlemen:

We are pleased to submit our revised fee proposal to provide engineering services for this study. Our services will be based on the following:

1. Calculations will be made for typical buildings identified in the Scope of Work. The results obtained from these buildings will be pro-rated and applied to other buildings.

2. The installation will provide the building drawings that we have been unable to locate.

3. We request that the operating and fuel logs including the fuel and consumption rates of the boiler plant at Building 437 be provided to us by October 5, 1992. This will allow us to initiate the study in a timely manner.

4. We understand that "entrance" and "exit" interviews will not be required for this study.

Thank you for your guidance and assistance.

Sincerely,

ENGINEERING APPLICATIONS CONSULTANTS, P.C.

Virender Puri

Virender Puri, P.E.
President

Enclosure

vp:cag

cc: cc

92002\letters\081192

APPENDIX D

PROGRAMMING DOCUMENTS

SUMMER STEAM SHUT DOWN
FORT MYER, VIRGINIA

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

1.0 INTRODUCTION

An Energy Savings Opportunity Survey (ESOS) was done in 1994 to improve energy efficiency by analyzing demand for steam during the summer (non-heating) months, and recommending an alternative to using the central steam plant, Building 447.

2.0 DESCRIPTION OF ECOS

The collected data was subjected to a detailed analysis based on Army criteria for qualifying for ECIP projects. Local gas fired boilers will be installed in the following buildings:

246	250	402	501
247	251	403	525
248	400	404	

Gas fired domestic hot water heaters will be installed in the following buildings:

249	407	416
405	410	450
406	411	469

The cost of this project is $852,000 (FY 1994) excluding design and supervision/inspection/overhead (SIOH) costs.

3.0 POTENTIAL SAVINGS

The alternative recommended above has a potential savings in energy consumption of 38,799 MBTU per year at a cost savings of $119,468 per year for energy, with an additional savings of $341,567 for non-energy related items. The recommended alternative has a total investment cost of $954,240 and yields a savings to investment ratio (SIR) of 7.45 with a simple payback of 2.07 years.

3.1 Metering

Presently, there is no provision for metering of the energy consumption of the systems affected by this project. The energy conservation measures recommended are based on field surveys, interviews with the operating personnel, and the Building 447 engineering log.

3.1.1 Calculations for energy savings were subjected to rigorous analysis, as per (ECIP) guidelines. However, the energy savings accrued will depend on the implementation as recommended, and following the recommended operational, maintenance, and repair procedures.

1. COMPONENT	FY 1996 MILITARY CONSTRUCTION PROJECTS DATA	2. DATE
ARMY		MARCH 1994

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
FORT MYER, VIRGINIA	ECIP: SUMMER STEAM SHUT DOWN

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST
	82000		$970,000

9. COST ESTIMATES

ITEM	U/M	QUAN-TITY	UNIT COST	COST ($000)
Install gas-fired boilers in buildings:				811.872
Building No. 246, 247, 248, 250, 251, 400, 402, 403, 404, 501, and 525				
Install gas-fired domestic water heaters in buildings:				
Building No. 249, 405, 406, 407, 410, 411, 416, 450, and 469				
Subtotal				811.872
Escalation to April 1996 (6.8%)				55.207
Subtotal				867.079
Contingency (5%)				43.354
Total Contract Cost				910.433
Supervision, Inspection & Overhead (6.0%)				54.626
Total Request				965.059
Total Request Rounded				970.000

10. **Description of Proposed Construction:**

The proposed project consists of installing gas-fired boilers and water heaters for summer use, to allow the central heating plant in Building 447 and the associated steam distribution system to be shut down during these non-heating months. The affected buildings are permanent facilities that serve barracks, family housing, medical, dining, mercantile, training, and recreation functions.

(The total installed net heating capacity is 14,098,800 btu/hour.)

11. **Project:**

This project will provide boilers and water heaters for summer use in 20 buildings at Fort Myer, Virginia.

Requirement: The project will help Fort Myer reduce energy consumption and operating and maintenance costs to comply with the Energy Resources Management Plan (ERMP).

FOR OFFICIAL USE ONLY
(WHEN DATA IS ENTERED)

1. COMPONENT ARMY	FY 1996 MILITARY CONSTRUCTION PROJECTS DATA	2. DATE MARCH 1994
3. INSTALLATION AND LOCATION FORT MYER, VIRGINIA		
4. PROJECT TITLE ECIP: SUMMER STEAM SHUT DOWN		5. PROJECT NUMBER

11. **Project:** (continued)

Current Situation: In order to meet summer use requirements of steam in these buildings, the central plant is operated during non-heating months and thus is wasting energy through the distribution system, and requires supervision by at least two personnel at all times.

Impact if Not Provided: If this project is not executed, Fort Myer will not achieve annual savings of $119,468 in energy costs, $341,567 in non-energy related costs, and a potential reduction in energy consumption of 38,799 Mbtu. The base will also fail to contribute to energy conservation goals established for US Army facilities by the Army headquarters.

Cost Development Study Date:	March	1994	Index:	1925
Estimated Construction Start:	January	1996	Index:	2046
Estimated Midpoint Construction:	April	1996	Index:	2055
Estimated Construction Completion:	July	1996	Index:	2075

Detailed Justifications

D-1 General: The project is dictated by the Army's goal to reduce energy consumption by making efficient use of energy resources at the facilities. This will increase the base's capability to achieve budgetary reductions.

D-2 Accommodations Now in Use: Under the existing arrangement, the central plant in Building 447 is operated year round. During summer (non-heating) months this plant has to run to meet partial load steam demand in only 20 buildings, thus requiring inefficient operation of the large plant and wasting energy through the distribution network and instantaneous water heaters in the individual buildings.

D-3 Analysis of Deficiency: The inefficient operation of the boiler plant in Building 447 contributes towards an estimated wastage of 38,799 Mbtu per year.

1. COMPONENT ARMY	FY 1996 MILITARY CONSTRUCTION PROJECTS DATA	2. DATE MARCH 1994
3. INSTALLATION AND LOCATION FORT MYER, VIRGINIA		
4. PROJECT TITLE ECIP: SUMMER STEAM SHUT DOWN		5. PROJECT NUMBER

D-4 Consideration of Alternatives: Various options have been evaluated thoroughly under an Energy Savings Opportunity Survey (ESOS). The recommended option for this project is feasible and meets predetermined economic criteria. The results of the ECIP life cycle cost analysis were a total project savings to investment ratio (SIR) of 7.45 and a simple payback period of 2.07 years.

D-5 Criteria for Proposed Project: The installation will be performed as per applicable codes, rules and regulations.

D-6 Program for Related Equipment: All required equipment will be furnished and installed as a part of this project.

D-7 Disposal of Present Assets: None of the present assets will require disposal.

D-8 Survival Measures: Not applicable.

D-9 Summary of Environmental Consequences: Environmental impact of this project is only beneficial. Reduced energy usage will conserve resources of fuel oil and those used in generation of electricity, and also result in reduction of emissions from the power plants.

D-10 Evaluation of Flood Hazard and Encroachment of Wetlands: Not applicable.

D-11 Economic Justification: Completion of the proposed project will result in net energy savings of 38,799 Mbtu and $461,035 annually in total operating costs.

D-12 Utility and Telecommunication Support: No additional utility or telecommunication support is required.

D-13 Protection of Historic Places and Archeological Sites: The only project element which has any potential impact on the historic character of any of the facilities is the installation of the flues to vent boiler and water heater exhaust gases. In the historically sensitive buildings (246, 247, 248, 249, 250, and 251), new flues will be installed using the existing brick chimneys as fire-rated chases. No portion of the stainless steel stacks will be visible on the building exteriors as terminations will be open end, flush with

the tops of the brick chimneys. One building (Building 250) requires reconstruction of a mechanical room chimney, with exterior brick construction to match existing installations.

D-14 Project Development Brochure: An engineering study was completed in March 1994, and an executive summary is attached.

D-15 Energy Requirements: The subject project will reduce present energy consumption by 38,799 Mbtu annually. See Energy Requirements Appraisal (ERA) in Special Requirements Paragraph 3 (SRP-3).

D-16 Provision for the Handicapped: The proposed project does not impact the architectural character of the buildings involved and, hence, no design for the handicapped is involved.

D-17 Real Property Maintenance Activity (RPMA) Analysis:

A. Physical Impact: There will be a decrease in maintenance activity or real property inventory. Fort Myer and, hence, the Army, will be benefitted by an annual cost savings of $341,567.

B. Backlog of Maintenance and Repair (BMAR) Impact: The systems' life expectancy will be positively affected due to periods of non-use. There will be no impact on BMAR.

D-18 Commercial Activities: The proposed project affects only provisions for summer steam requirements of existing activities and does not involve expansion of any facilities for any new function.

Special Requirements Paragraph 3 (SRP3):

Energy Requirements Appraisal (ERA)

1. Project Description: Gas-fired boilers and water heaters will be installed in the buildings named in Block 9 at Fort Myer, Virginia.

2. Estimated Energy Consumption: The existing systems consume an estimated 57,530 Mbtu during the summer (non-heating) months. The project, when fully implemented, will generate net annual energy savings of 38,799 Mbtu.

1.COMPONENT	FY 1996 MILITARY CONSTRUCTION PROJECTS DATA	2. DATE
ARMY		MARCH 1994

3. INSTALLATION AND LOCATION

FORT MYER, VIRGINIA

4. PROJECT TITLE	5. PROJECT NUMBER
ECIP: SUMMER STEAM SHUT DOWN	

3. Energy Sources: The use of residual (#6) oil, electricity, and natural gas will decrease during the summer months.

4. Energy Use Impacts: The proposed project will require an augmentation of the existing natural gas distribution system. The burden on the existing fuel oil systems will be relieved.

5. Energy Conservation: The annual energy consumption will be reduced by 38,799 Mbtu annually.

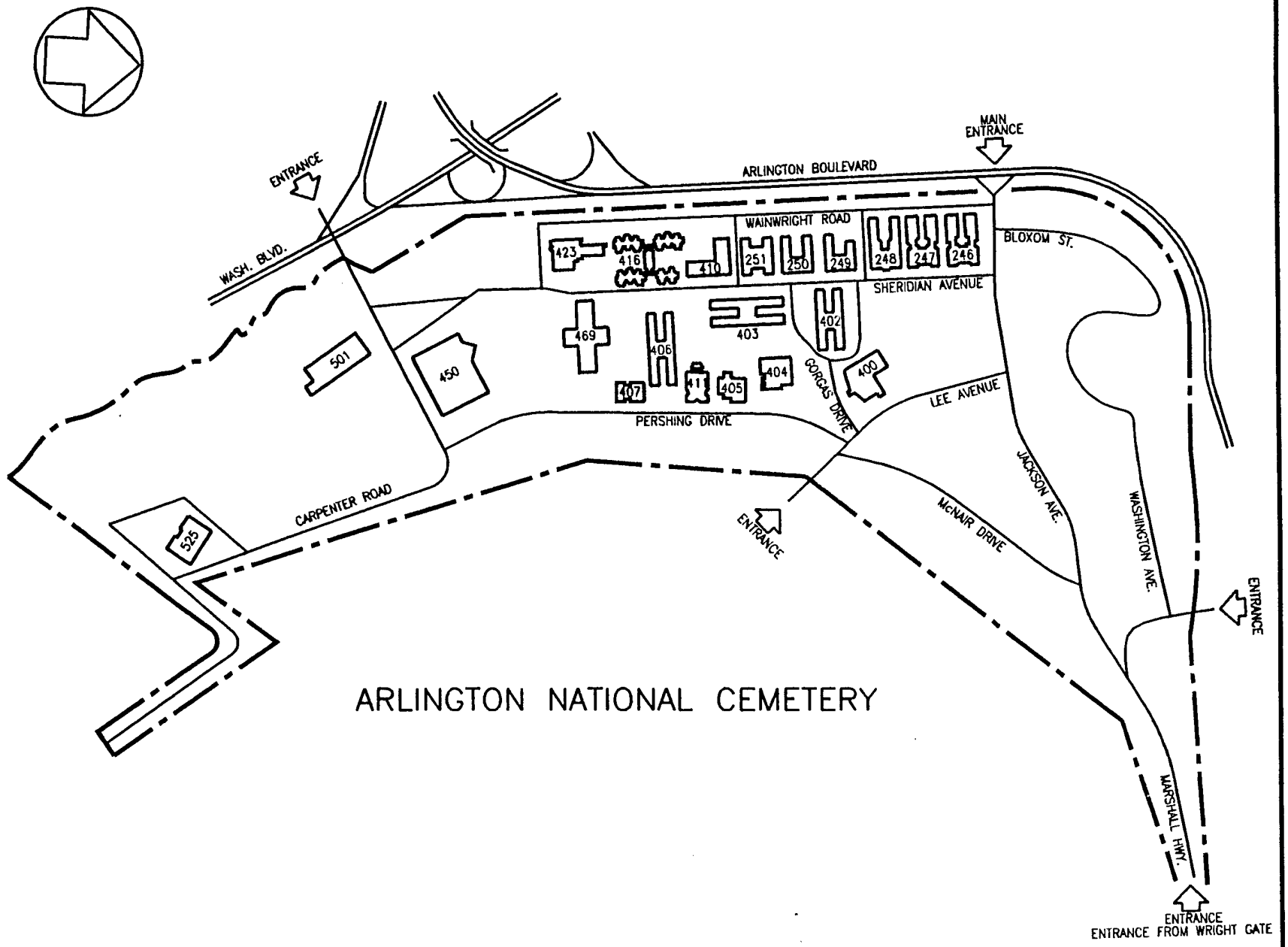
6. Energy Alternatives: The proposed retrofit will reduce summer period steam energy consumption by 67% (38,799 Mbtu) without affecting the base mission.

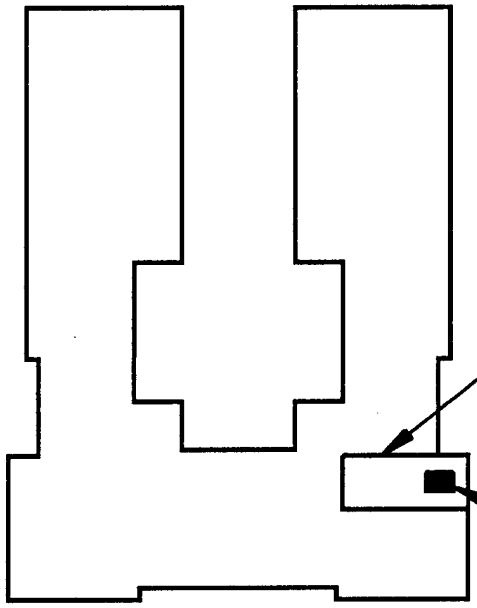
7. Energy Effects: The proposed improvements have a positive environmental effect. By reducing demand for energy, it effectively reduces consumption of non-renewable fuel sources and resulting polluting emissions from electric generation.

8. Basis of Approval: Total energy requirements and alternative fuel sources have been considered and included in this appraisal or discarded as inapplicable.

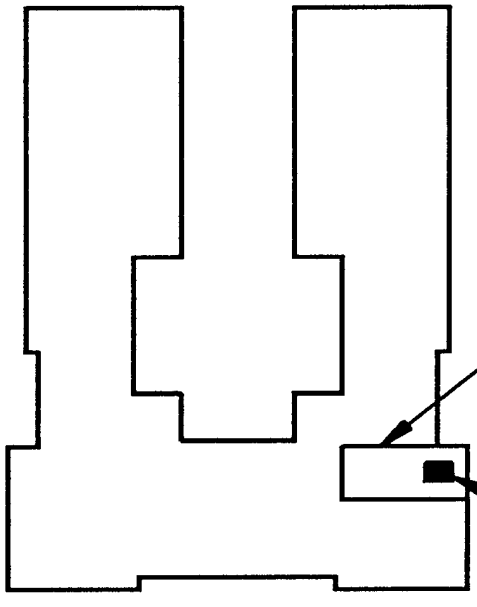
SUMMER STEAM SHUT DOWN
FORT MYER, VIRGINIA

SITE PLAN





BASEMENT KEY PLAN
BUILDING 247

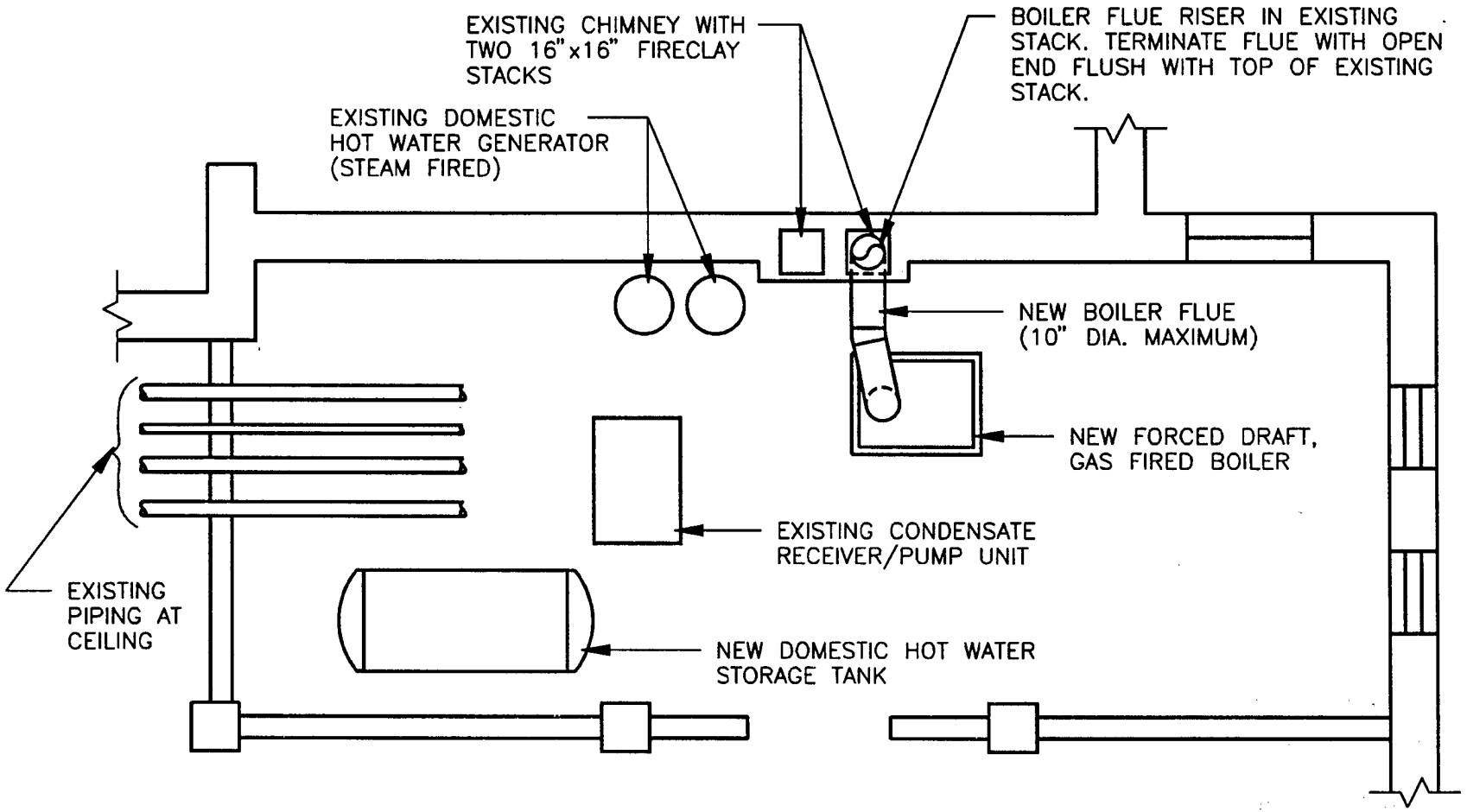


BASEMENT KEY PLAN
BUILDING 246

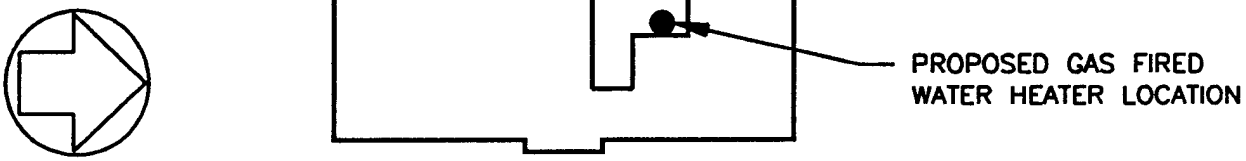
SUMMER STEAM SHUT DOWN FORT MYER, VIRGINIA	SK–1

SUMMER STEAM SHUT DOWN
FORT MYER, VIRGINIA

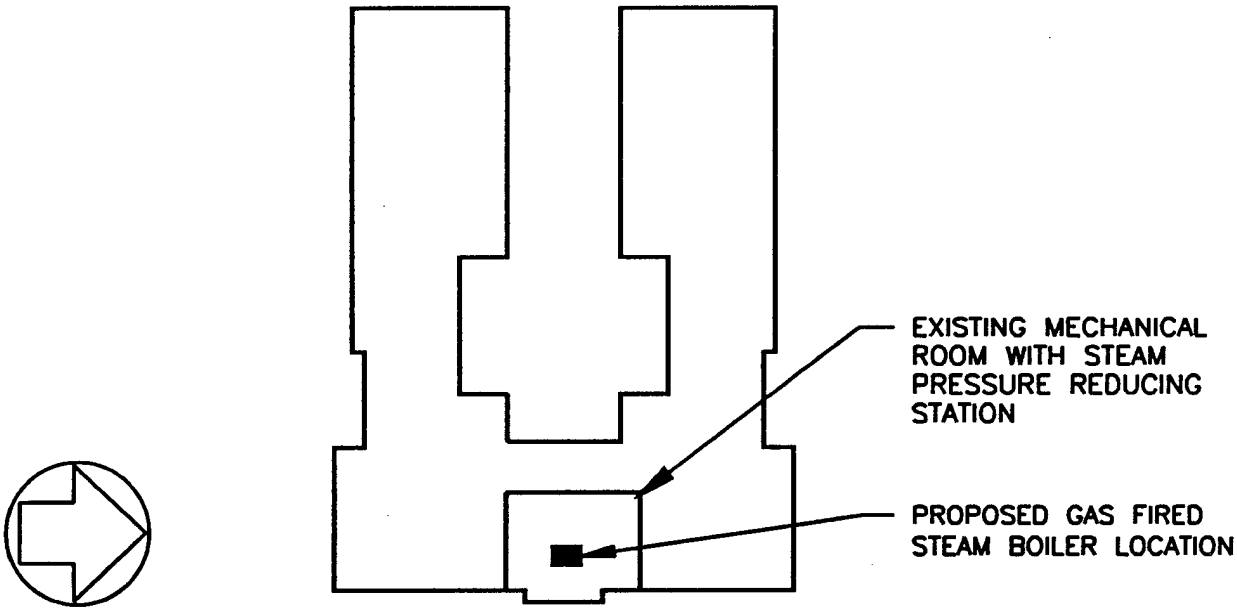
SK-1A



MECHANICAL ROOM PLAN – BUILDING 246
(BUILDINGS 247, 248 AND 251 SIMILAR)

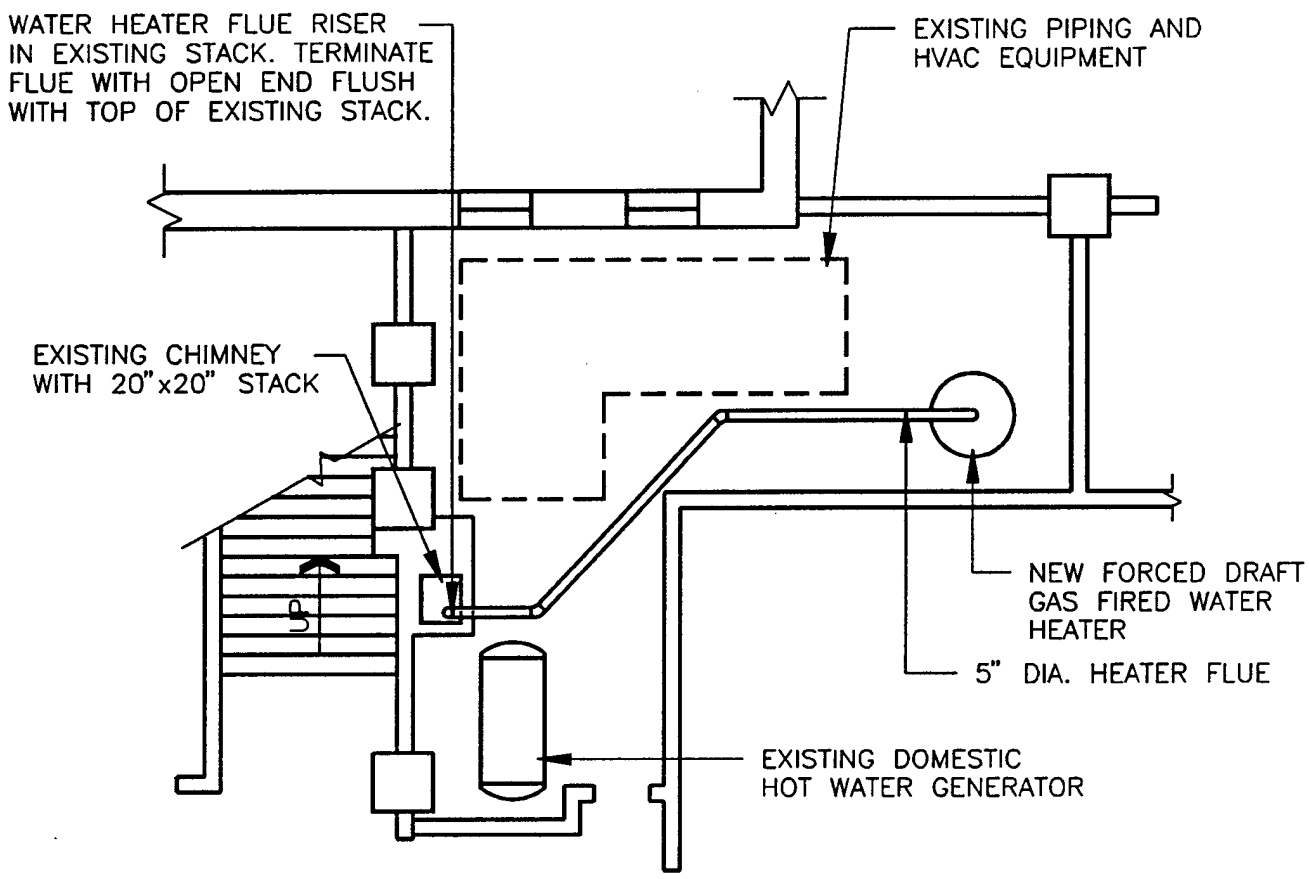


BASEMENT KEY PLAN
BUILDING 249



BASEMENT KEY PLAN
BUILDING 248

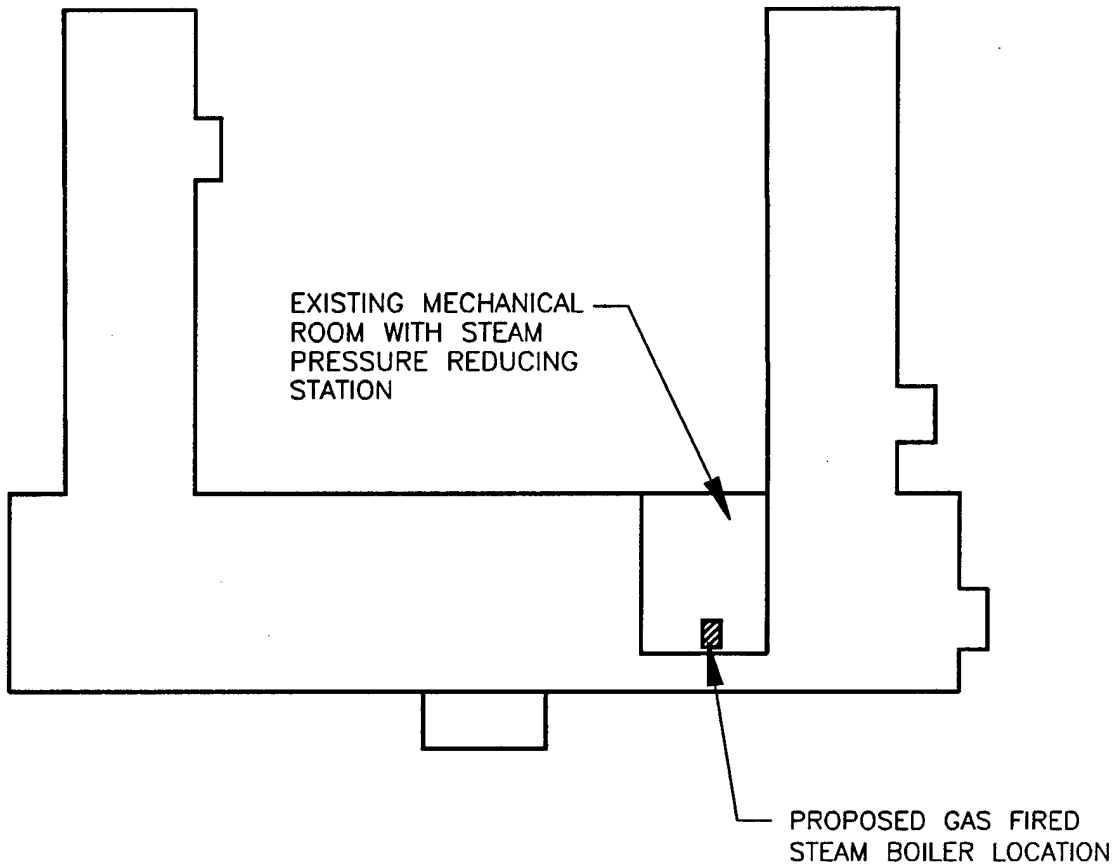
SUMMER STEAM SHUT DOWN FORT MYER, VIRGINIA	SK–2



MECHANICAL ROOM PLAN – BUILDING 249

SUMMER STEAM SHUT DOWN
FORT MYER, VIRGINIA

SK–2A



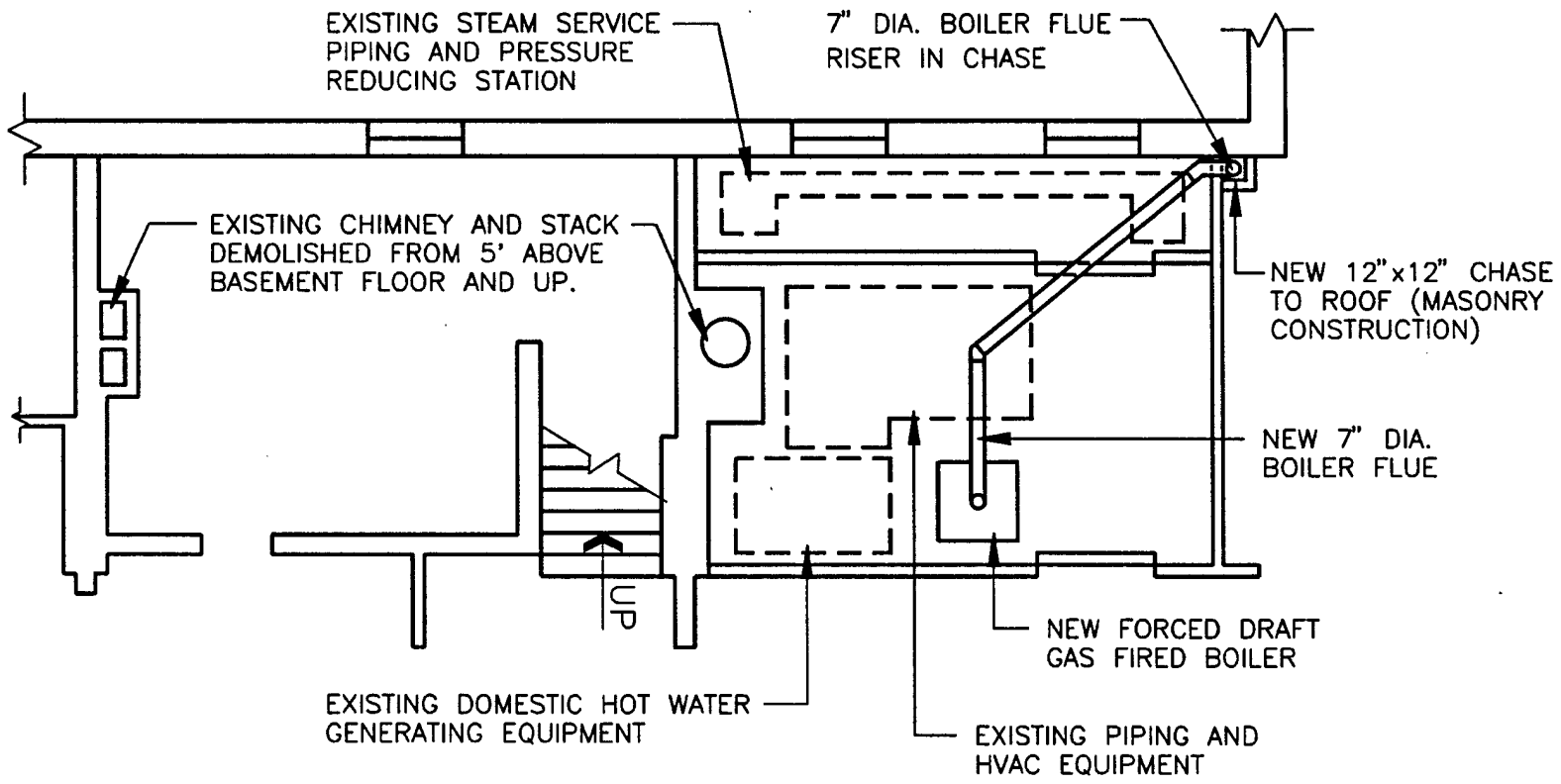
BASEMENT KEY PLAN
BUILDING 250

SUMMER STEAM SHUT DOWN
FORT MYER, VIRGINIA

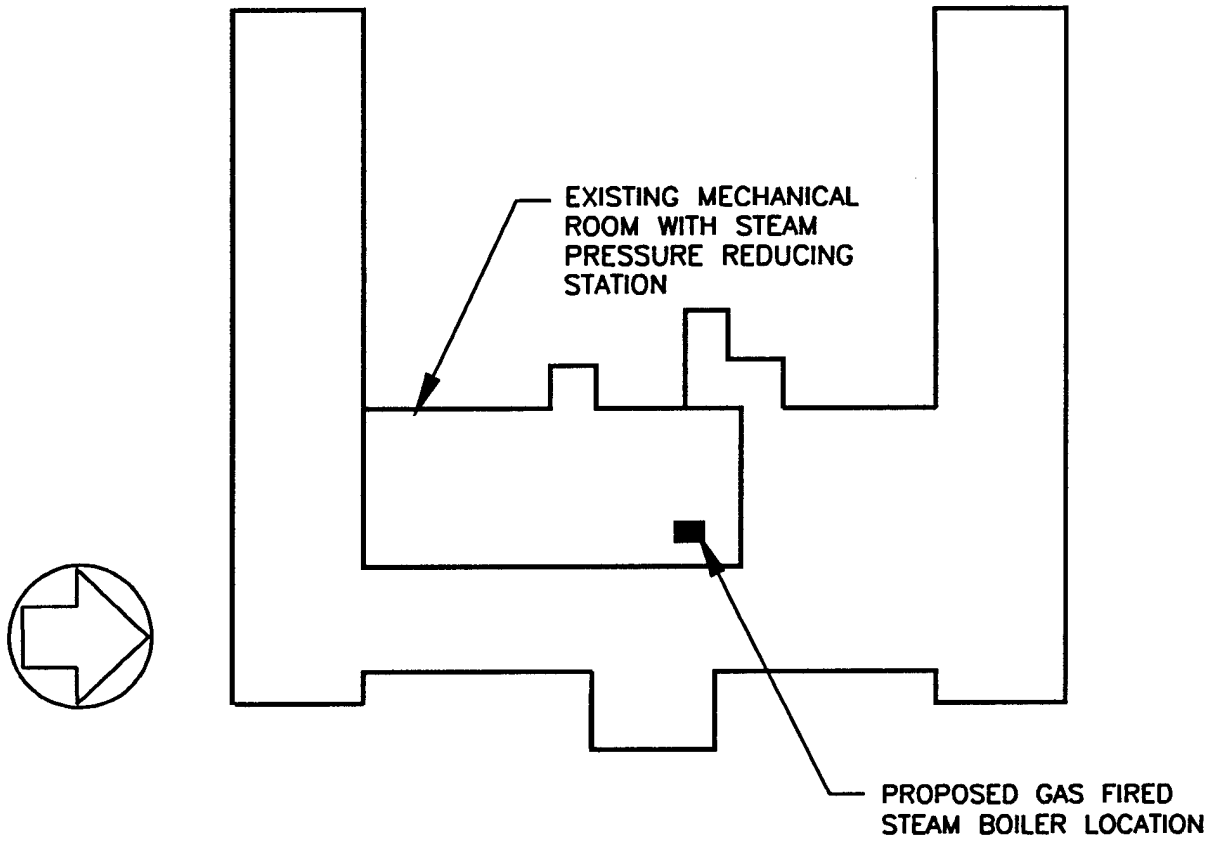
SK-3

SUMMER STEAM SHUT DOWN
FORT MYER, VIRGINIA

SK-3A



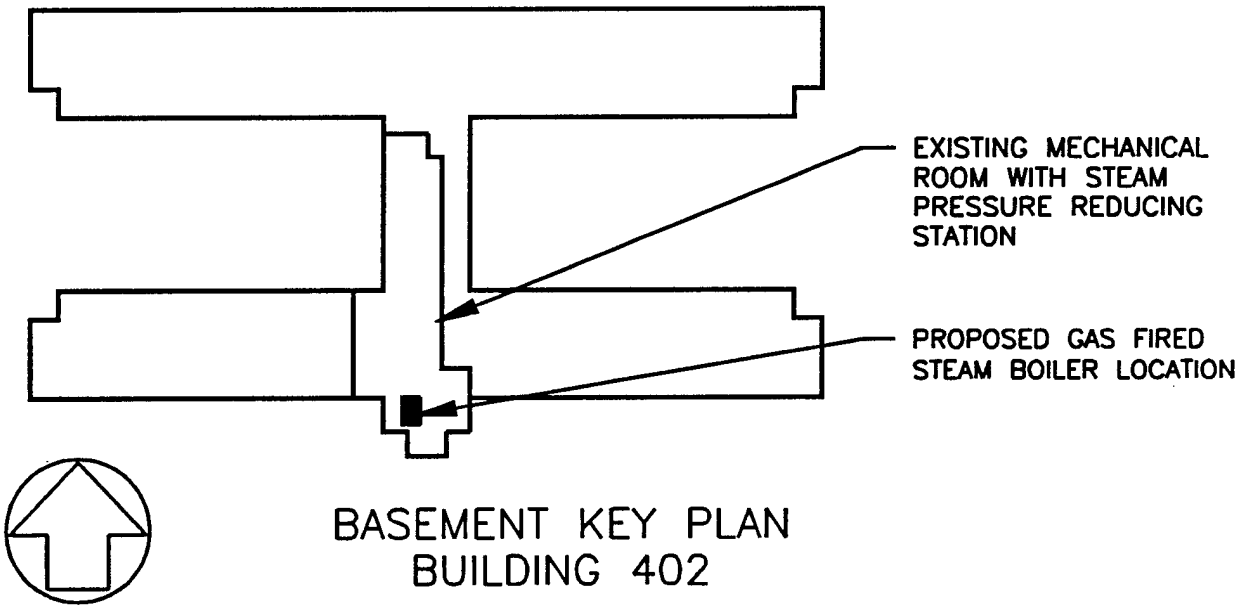
MECHANICAL ROOM PLAN – BUILDING 250



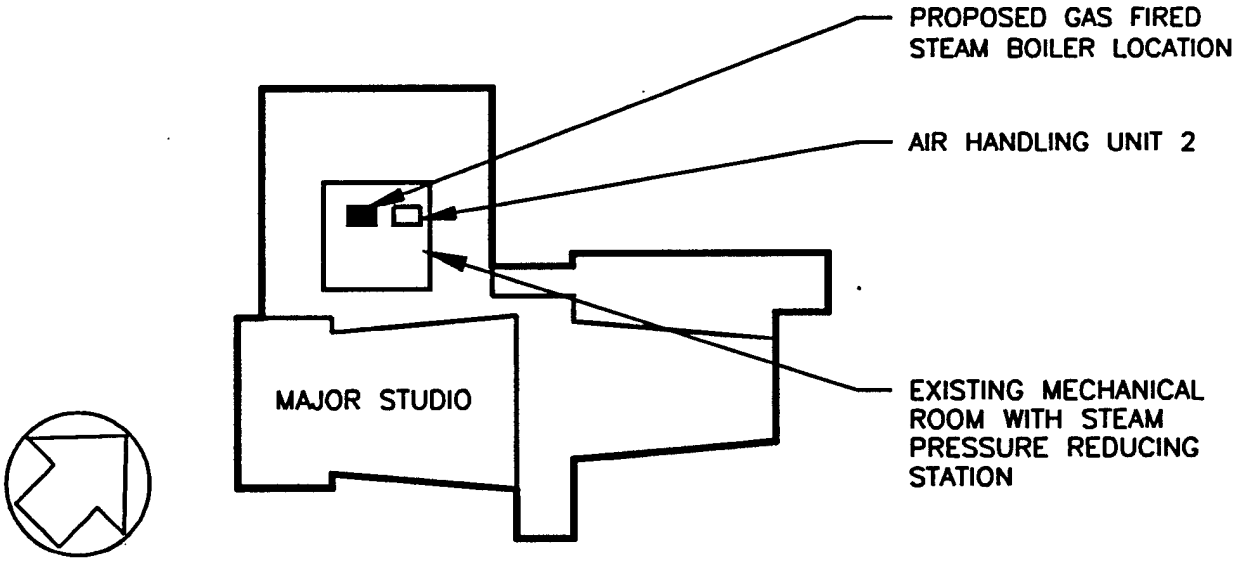
BASEMENT KEY PLAN
BUILDING 251

SUMMER STEAM SHUT DOWN
FORT MYER, VIRGINIA

SK-4

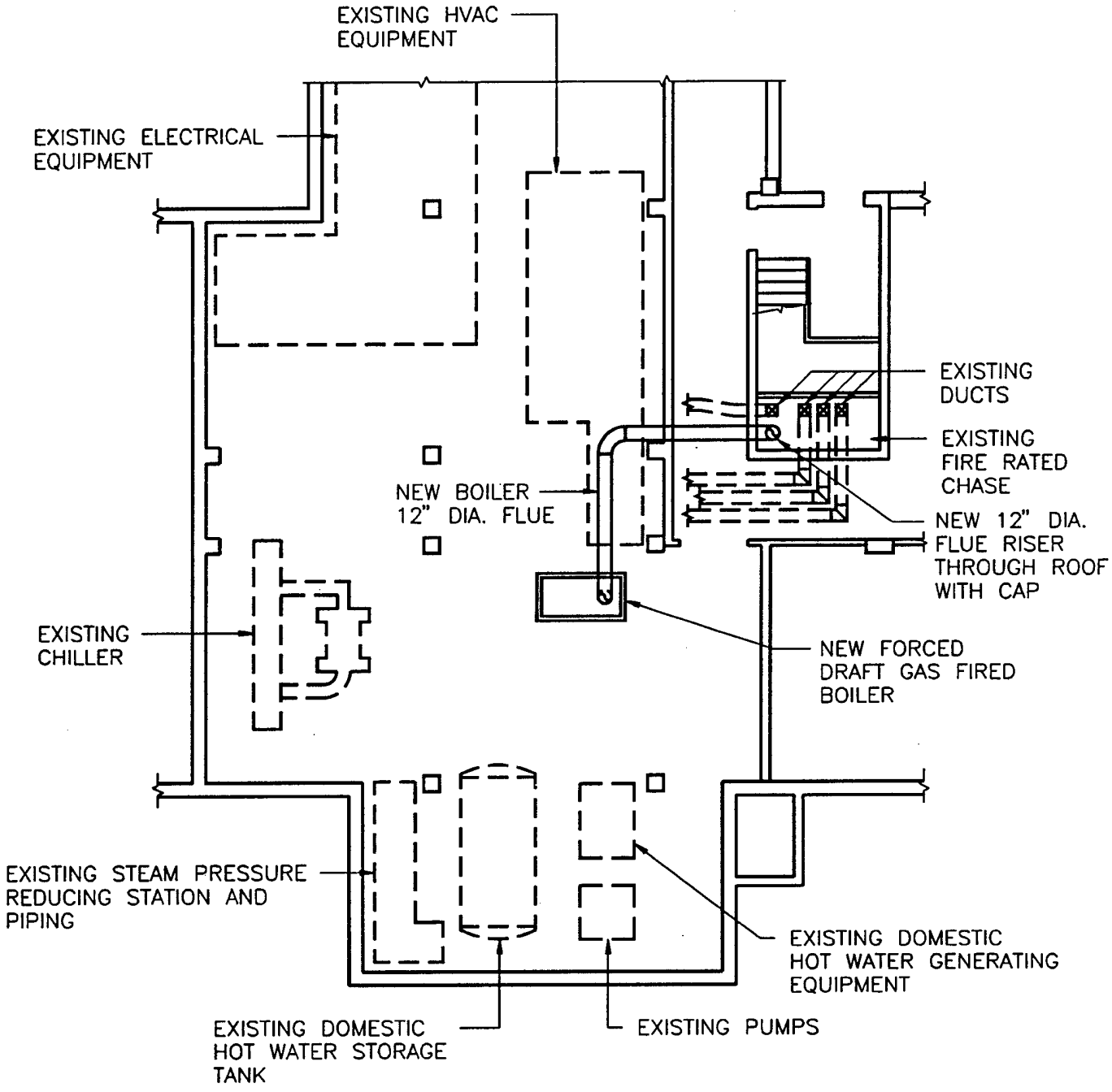


BASEMENT KEY PLAN
BUILDING 402



UPPER LEVEL KEY PLAN
BUILDING 400

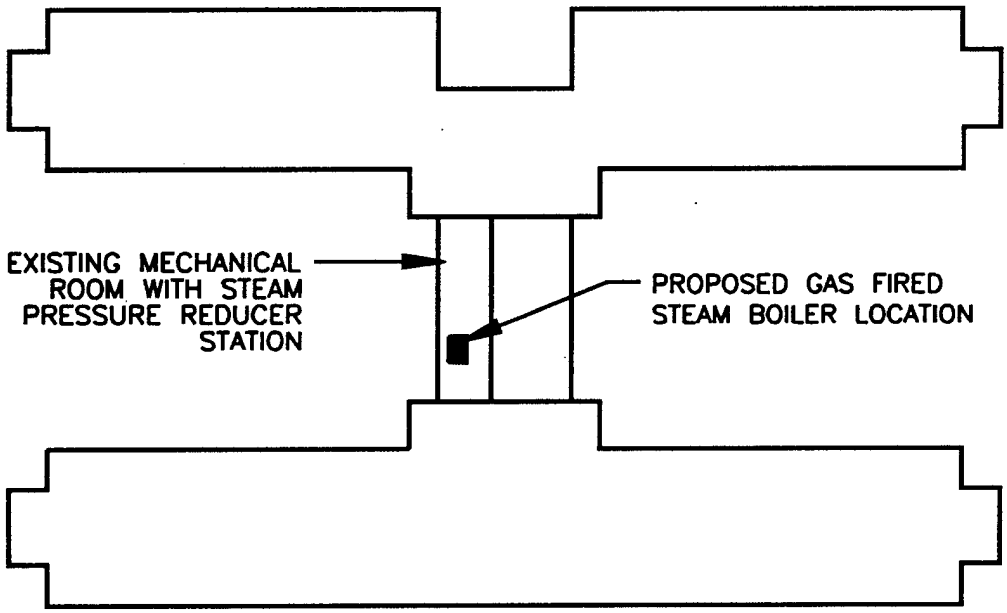
SUMMER STEAM SHUT DOWN FORT MYER, VIRGINIA	SK–5



MECHANICAL ROOM PLAN
BUILDING 402
(BUILDINGS 403 AND 406 SIMILAR)

SUMMER STEAM SHUT DOWN
FORT MYER, VIRGINIA

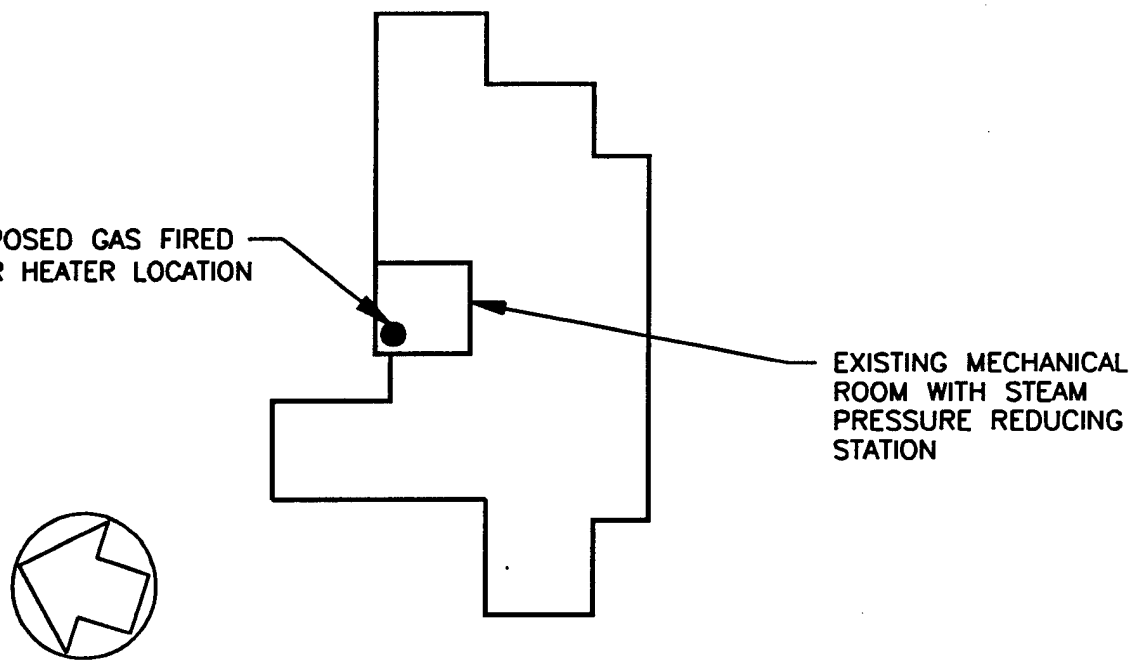
SK-5A



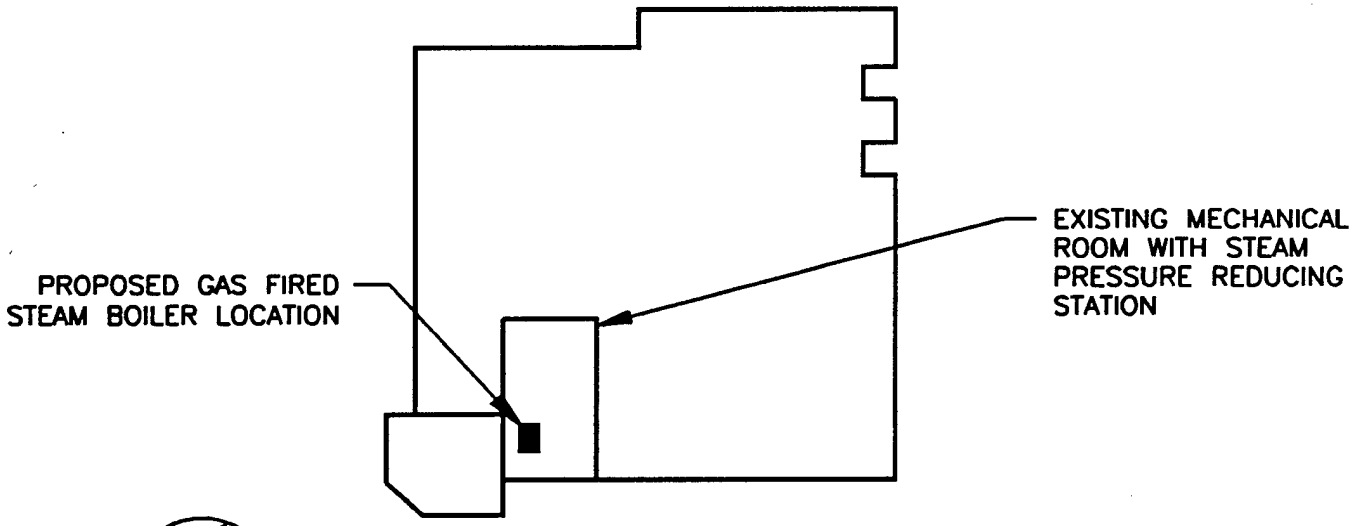
BASEMENT KEY PLAN
BUILDING 403

SUMMER STEAM SHUT DOWN
FORT MYER, VIRGINIA

SK-6



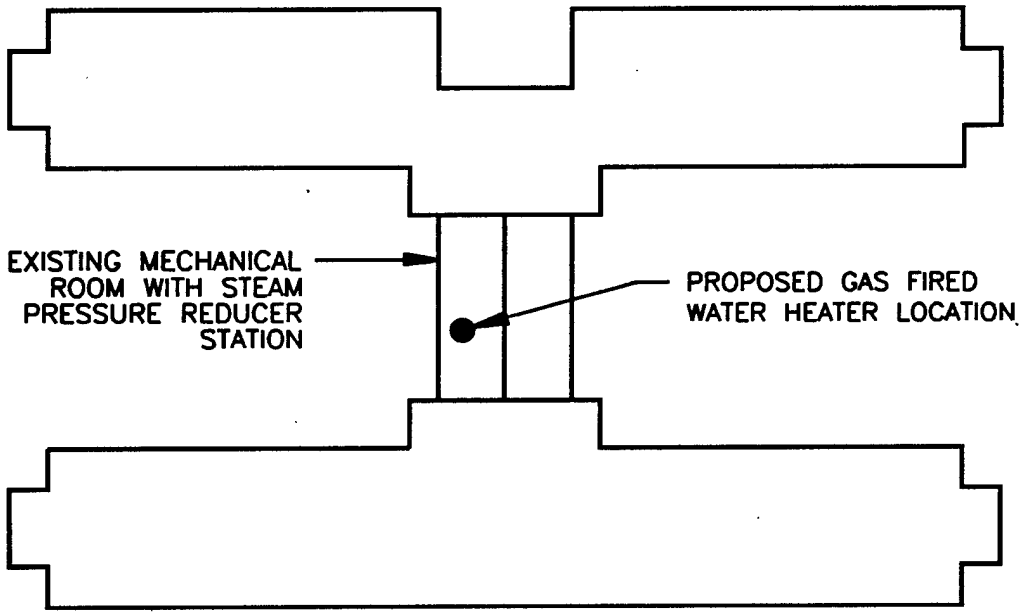
FIRST FLOOR KEY PLAN
BUILDING 405



FIRST FLOOR KEY PLAN
BUILDING 404

SUMMER STEAM SHUT DOWN
FORT MYER, VIRGINIA

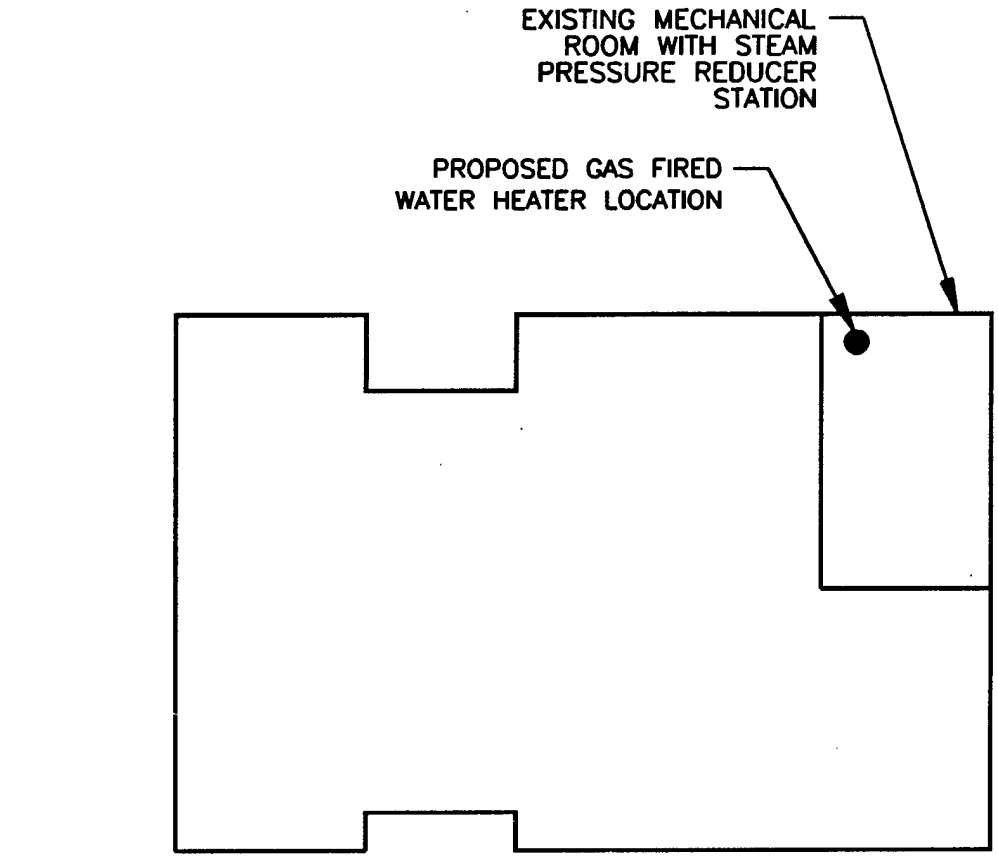
SK-7



BASEMENT KEY PLAN
BUILDING 406

SUMMER STEAM SHUT DOWN
FORT MYER, VIRGINIA

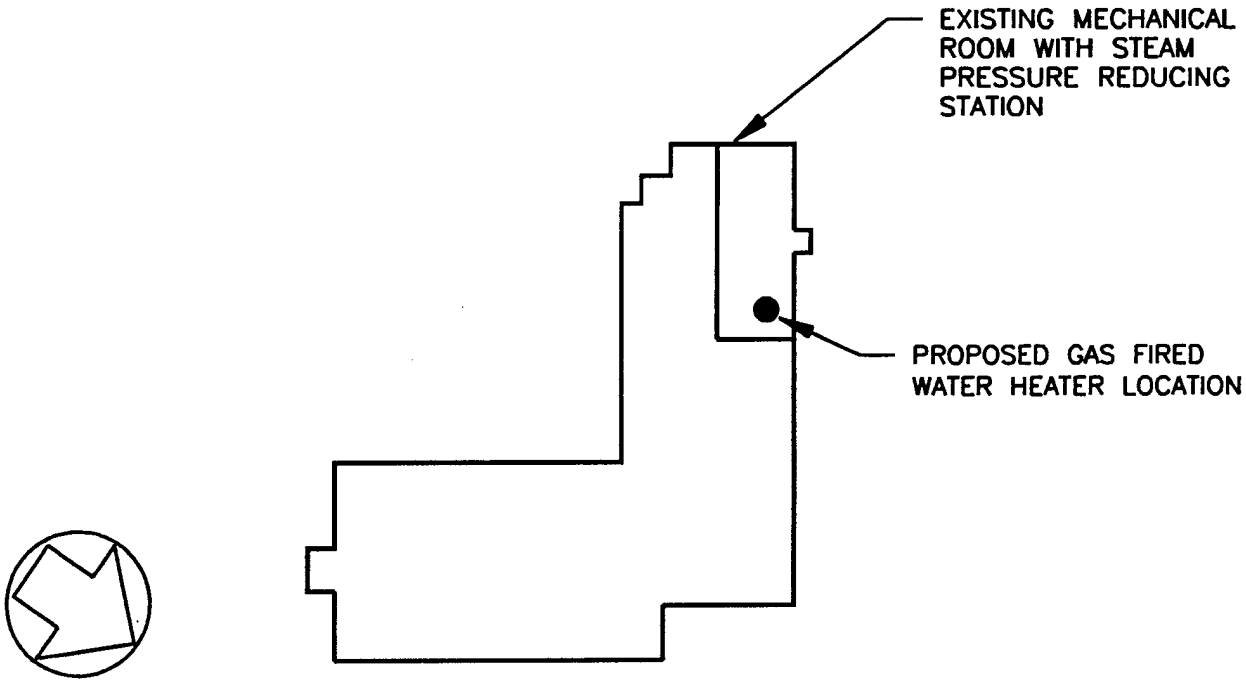
SK-8



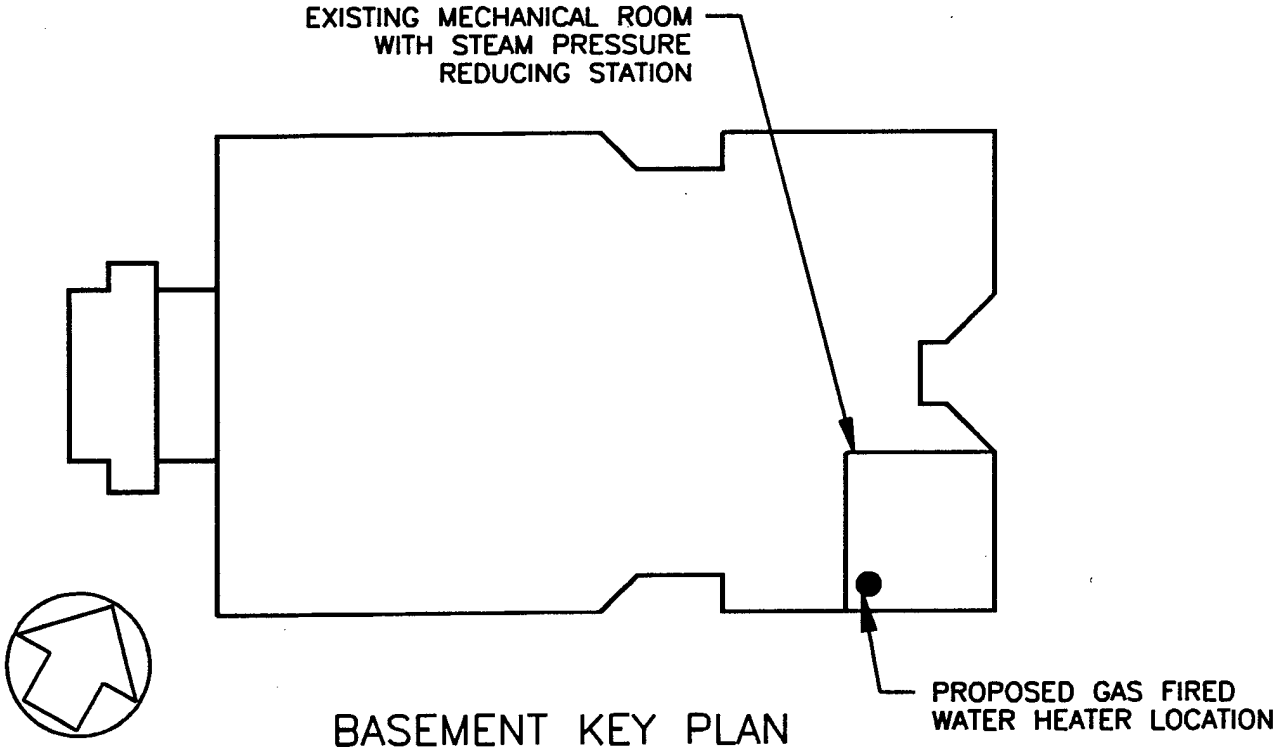
BASEMENT KEY PLAN
BUILDING 407

SUMMER STEAM SHUT DOWN
FORT MYER, VIRGINIA

SK-9



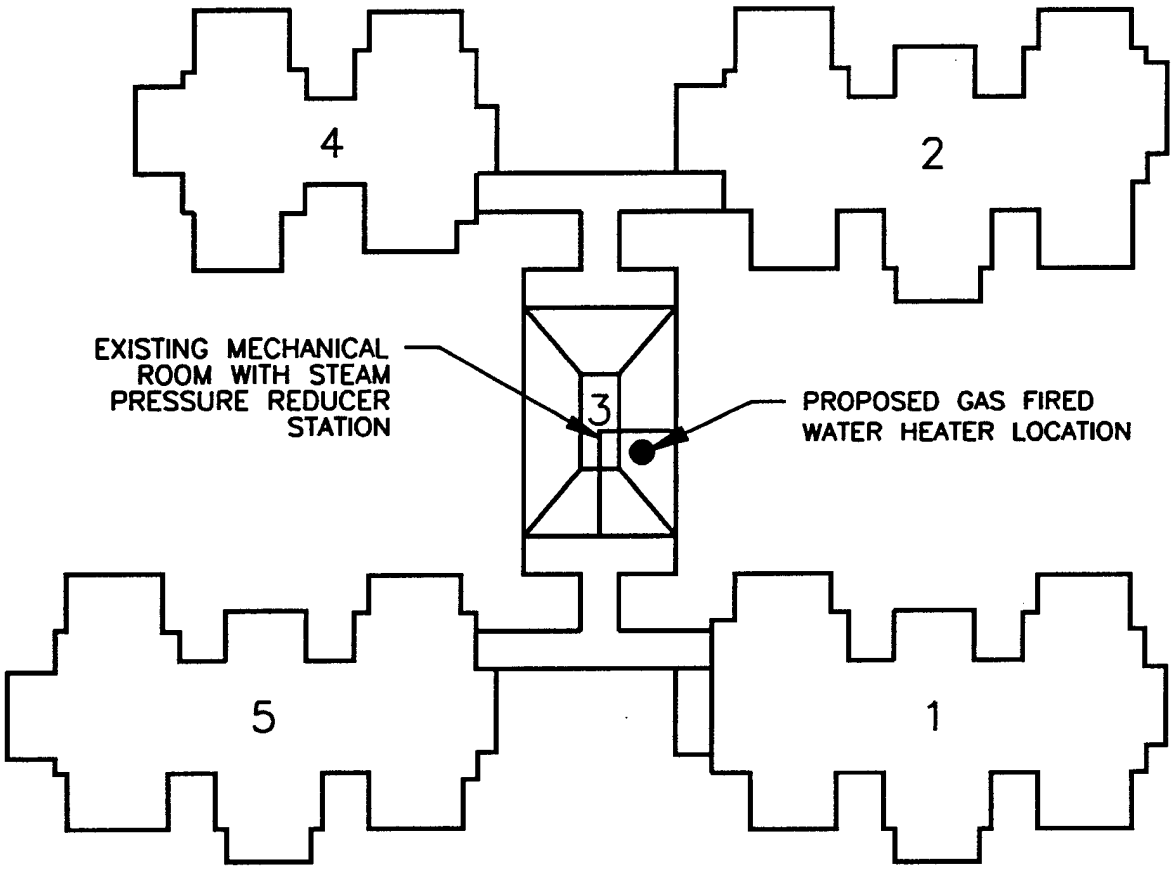
BASEMENT KEY PLAN
BUILDING 410



BASEMENT KEY PLAN
BUILDING 411

SUMMER STEAM SHUT DOWN
FORT MYER, VIRGINIA

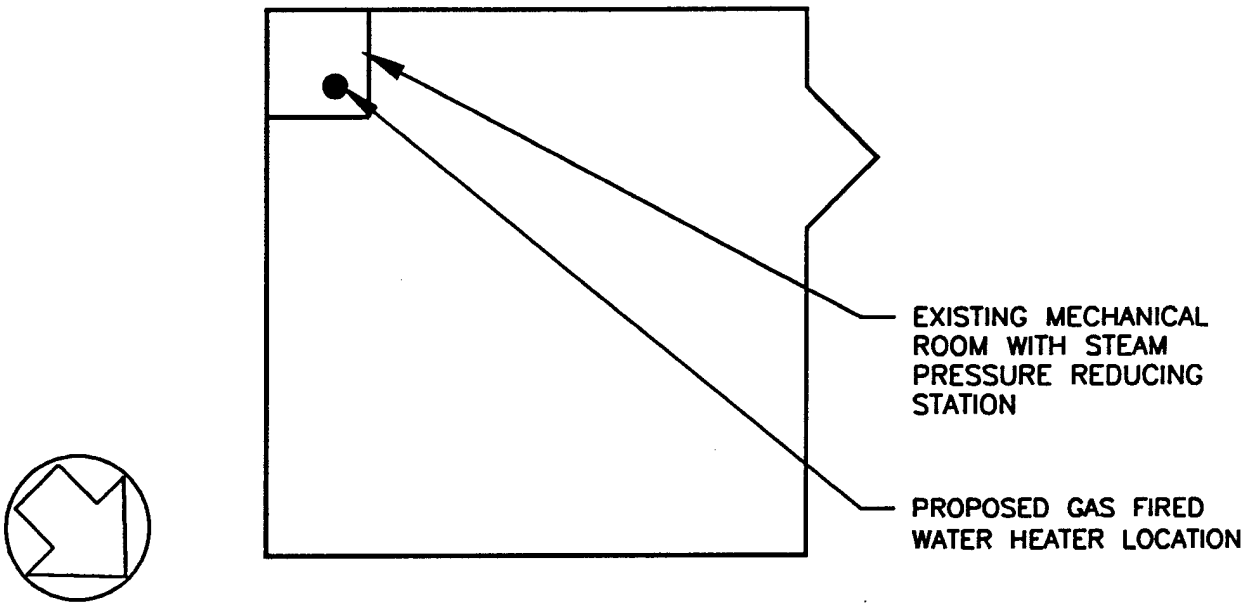
SK-10



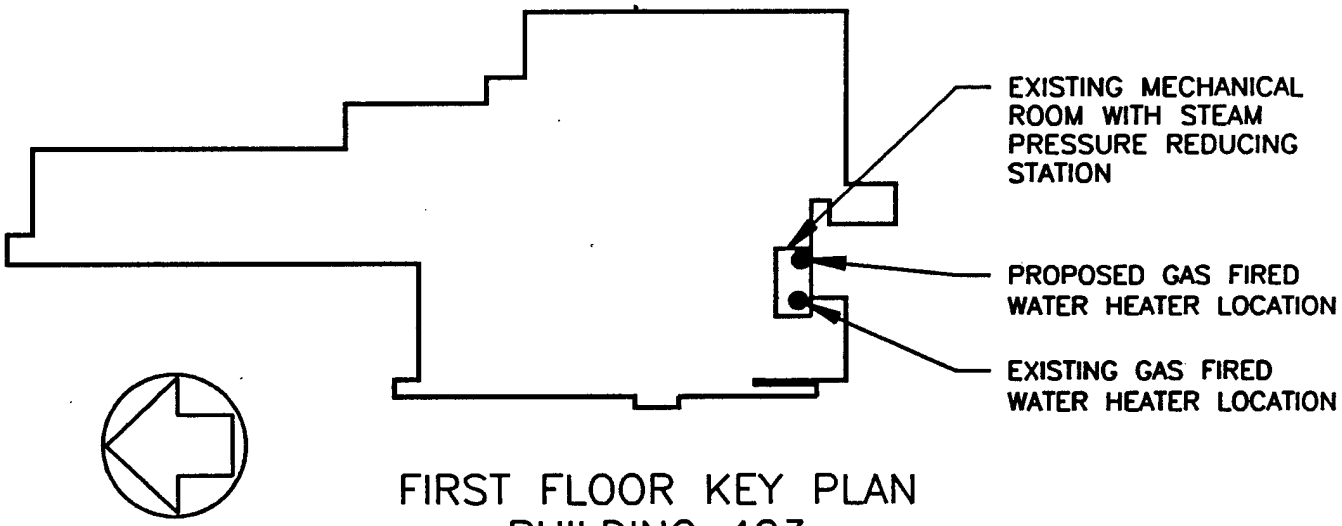
BASEMENT KEY PLAN
BUILDING 416

SUMMER STEAM SHUT DOWN
FORT MYER, VIRGINIA

SK-11



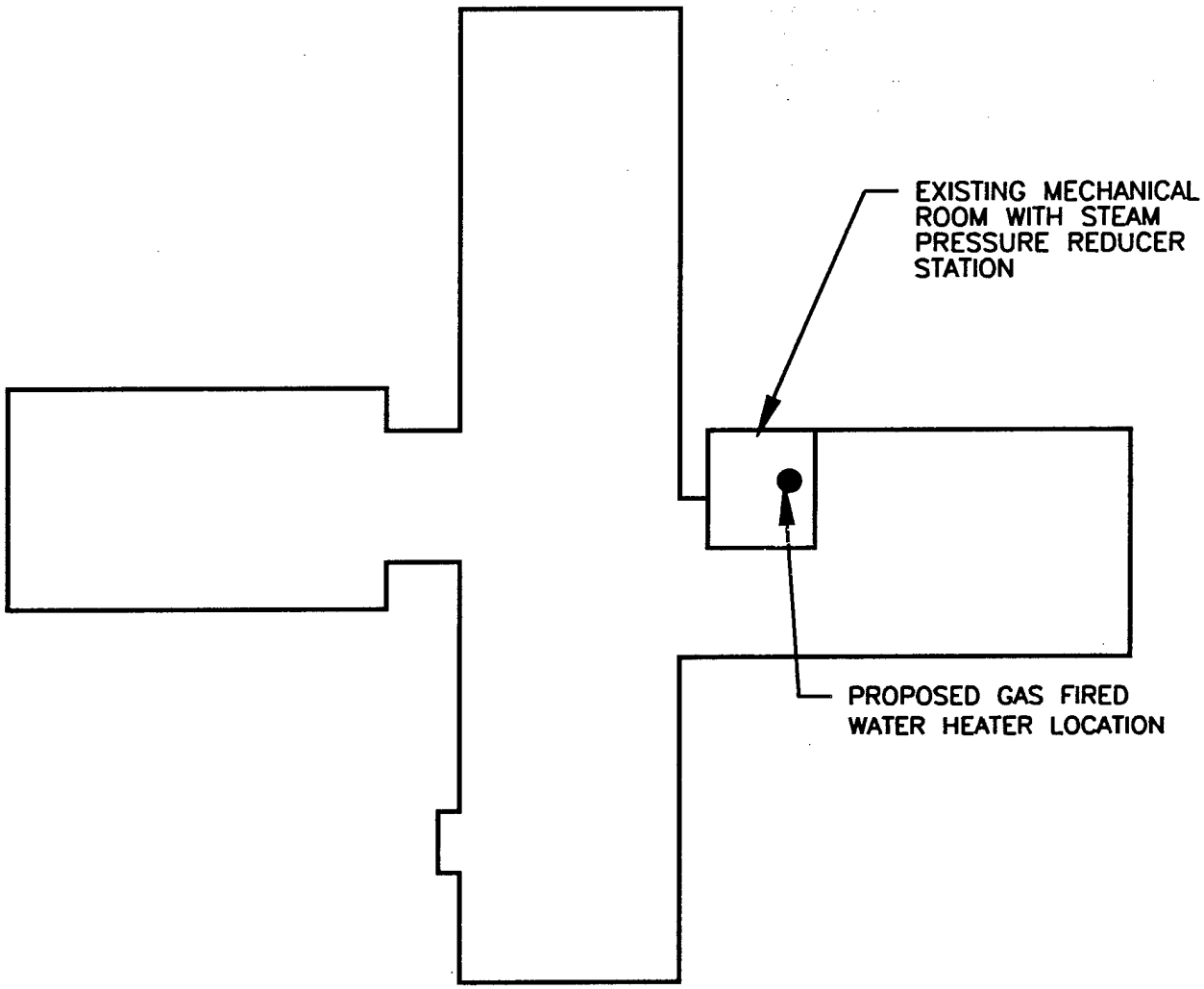
FIRST FLOOR KEY PLAN
BUILDING 450



FIRST FLOOR KEY PLAN
BUILDING 423

SUMMER STEAM SHUT DOWN
FORT MYER, VIRGINIA

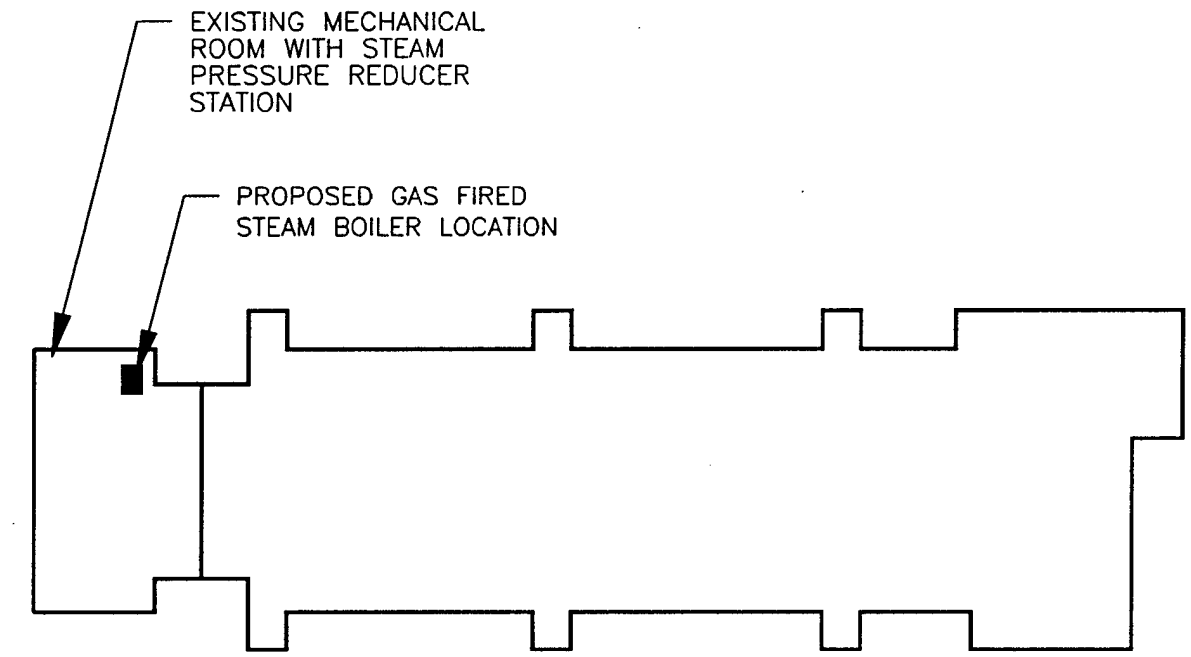
SK-12



BASEMENT KEY PLAN
BUILDING 469

SUMMER STEAM SHUT DOWN
FORT MYER, VIRGINIA

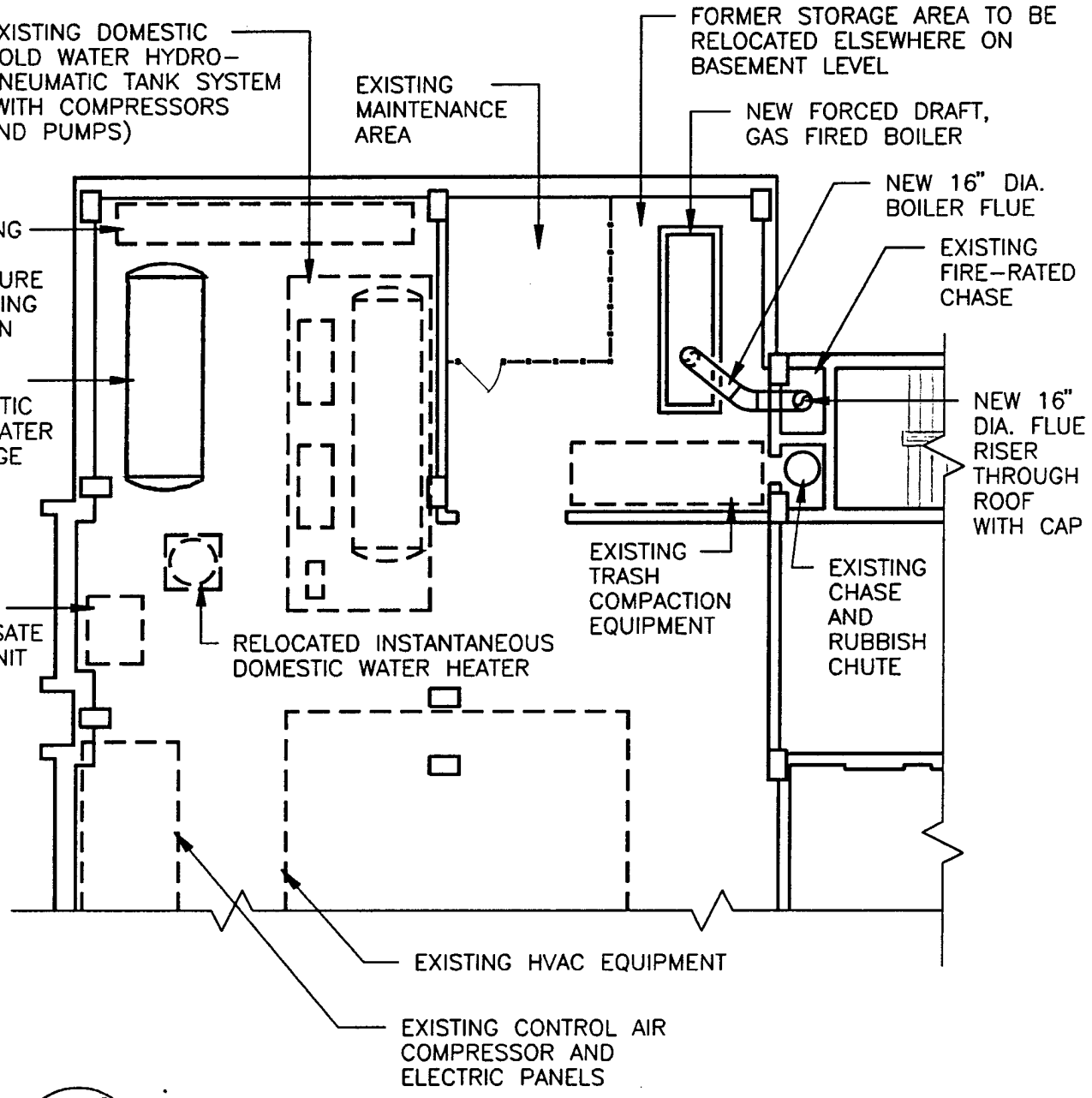
SK-13



BASEMENT KEY PLAN
BUILDING 501

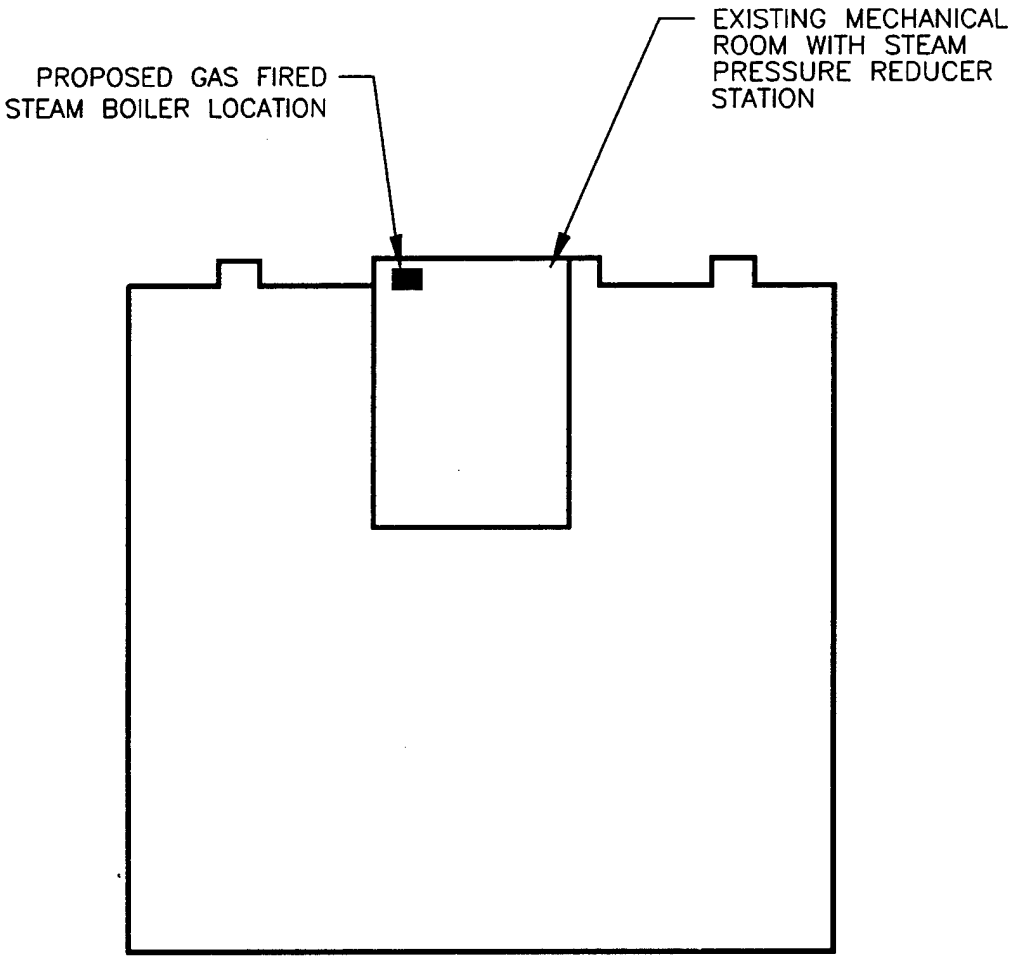
SUMMER STEAM SHUT DOWN
FORT MYER, VIRGINIA

SK-14



PARTIAL MECHANICAL ROOM PLAN
BUILDING 501

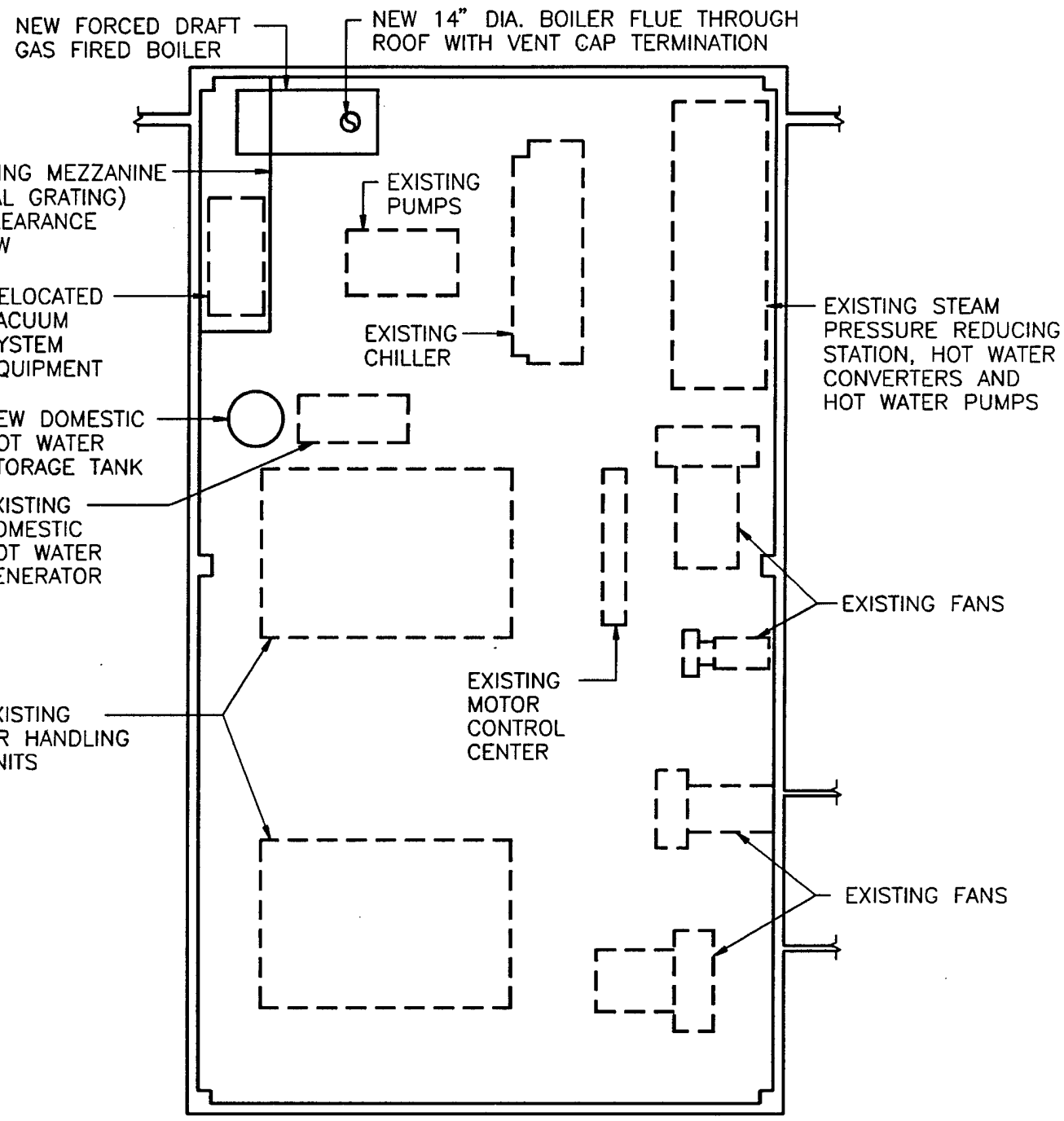
SUMMER STEAM SHUT DOWN FORT MYER, VIRGINIA	SK-14A



BASEMENT KEY PLAN
BUILDING 525

SUMMER STEAM SHUT DOWN
FORT MYER, VIRGINIA

SK-15



MECHANICAL ROOM PLAN
BUILDING 525

SUMMER STEAM SHUT DOWN
FORT MYER, VIRGINIA

SK-15A

ENERGY SAVINGS OPPORTUNITY SURVEY
FORT MYER, ARLINGTON, VIRGINIA

SUMMER STEAM SHUT-DOWN STUDY

A/E CONTRACT NO.
DACA 31-89-C-0198

VOLUME I

Executive Summary

Prepared for

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT CORPS OF ENGINEERS
BALTIMORE, MARYLAND

By

ENGINEERING APPLICATIONS CONSULTANTS, P.C.
9004-B CROWNWOOD COURT
BURKE, VIRGINIA 22015

March 1994

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Notes generated from Field Investigations

1. INTRODUCTION

Fort Myer is a permanent United States Army installation located in Arlington County, Virginia, on a site backing Arlington National Cemetery and overlooking the Potomac River and Washington, D.C. The installation consists of offices, family housing, Army Band facilities, supporting facilities, and barracks buildings including those known as the "Old Guard Barracks" which house soldiers that provide services at Arlington National Cemetery.

This report consists of the Summer Steam Shut Down Study of an Energy Savings Opportunity Survey (ESOS) for Fort Myer. The purpose of the study is to improve energy efficiency at Fort Myer by analyzing the effects and benefits of closing the central steam producing boiler facility during the non-heating months from mid-May to mid-October. Currently, the central steam plant operates through this period to provide heat for the various domestic hot water, steam driven laundry presses, air conditioning system reheat, food preparation and dishwashing demands of twenty-two buildings on the base.

This project is conducted in support of the National Energy Conservation Policy Act (NECPA). ESOS projects have the prime objective of evaluating energy conservation opportunities (ECOs) in quest of meeting the goals of the NECPA, the Army Energy Plan, and the Department of Defense Energy Management Plan.

This study constitutes a final submittal and includes the project criteria and the methodology used for conducting this analysis. The study also includes an Energy Conservation Investment Program (ECIP) analysis summary for each alternative or ECO that was evaluated.

Engineering services for this project are being provided by Engineering Applications Consultants, P.C. under contract number DACA 31-89-C-0198 for the Department of the Army, Baltimore District Corps of Engineers.

Significant assistance and cooperation for this analysis has been provided by the Corps of Engineers and the operations personnel at Fort Myer. EAC wishes to extend special appreciation to Mr. Jim Hawk, Mr. Ralph Gibson, and Mr. Richard Rice for their cooperation and guidance which has contributed to the development of this study.

2. PROJECT SUMMARY AND RECOMMENDATIONS

This study contains the findings of the Summer Steam Shut Down Study at Fort Myer, Virginia, and is based on field survey, discussions with the users and the operating personnel, and the review of drawings and other documents whenever available. Volumes I and II of this study contain the executive summary, project criteria, study methodology, building narratives, and the results of the analysis. Volume III contains calculations and supporting data for the study.

The project criteria lists environmental conditions within the buildings and climatic data applicable to the project site. Also included under project criteria are the fuel rates, economic life of the improvements, and discount factors used in this analysis.

The methodology section of this study contains a description of energy conservation opportunities (alternatives) considered, and the procedures for calculating the energy savings. The nature of the alternatives outlined in the scope of work provides for no interaction or "overlapping" of energy saving measures, and thus no synergistic effects between ECO's exist.

This analysis investigates the economic feasibility of providing the buildings listed with an alternate source of steam during the non-heating months. The buildings considered for evaluation of summer steam requirements are 246, 247, 248, 249, 250, 251, 400, 402, 403, 404, 405, 406, 407, 410, 411, 416, 423, 450, 452, 469, 501, and 525. Of these 22 buildings covered under this study, 11 were selected to be surveyed to establish baseline criteria for each type of building. From the baseline criteria, prorated results could then be estimated for the remaining buildings. The buildings surveyed were 246, 249, 400, 402, 404, 407, 411, 423, 450, 501, and 525. Due to unique variations within some of the buildings not surveyed, additional field investigations were performed to verify and improve the "models" used to represent them.

The following alternatives for independent steam and hot water generation have been considered:

Alternative 1 — Provide one gas-fired individual boiler in each of the 22 buildings.

Alternative 2 — Provide one central gas-fired boiler to serve Enlisted Barracks buildings 246, 247, 248, 250, and 251; and provide one gas-fired individual boiler in each of the 17 other buildings. Due to the requirements of the Enlisted Barracks "central" boiler, a remote structure will be required, and thus only one location has been analyzed.

Alternative 3 — Provide electric boilers in lieu of gas-fired boilers where applicable.

Alternative 4 — a. Provide condensing type gas-fired boilers (or high efficiency type) in lieu of standard gas-fired boilers, as applicable, in Alternative 1.

b. Provide condensing type gas-fired boilers (or high efficiency type) in lieu of standard gas-fired boilers, as applicable, in Alternative 2.

The results of this analysis are that all of the alternatives examined meet the qualifications for the ECIP program (refer to section Energy Plan below).

Table 1. ECIP Analysis Results

	Total	Annual Energy Savings (MBTU)				Annual Savings ($)			Simple
Alt.	Investment	Elec.	Oil	Gas	Total	Energy	Non-Energy	SIR	Payback
1	$ 954,240	249	14,909	23,641	38,799	119,468	341,567	7.45	2.07 yrs
2	$ 956,480	206	14,909	23,830	38,946	120,163	341,567	7.45	2.07 yrs
3	$1,002,400	-537	14,909	24,627	38,999	102,160	340,630	6.86	2.26 yrs
4a	$1,013,600	251	14,909	23,797	38,957	120,502	341,567	7.03	2.19 yrs
4b	$1,015,840	208	14,909	23,987	39,104	121,209	341,567	7.04	2.20 yrs

Though the alternatives provide slightly different approaches to meeting summer period steam demands, there are two key factors common to all alternatives that dictated the close results, leaving only small differences between the alternatives. Energy savings range from 38,799 MBTU in Alternative 1 to 38,957 MBTU in Alternative 4, and total monetary savings range from $442,790 in Alternative 3 to $462,776 in Alternative 4.

One reason for the similar results among the alternatives is that for many of the buildings studied, the steam demand was large enough to prohibit the use higher efficiency equipment. Thus a major portion of each alternative consists of the same large gas-fired boilers. As seen with Alternatives 3, 4a and 4b, when the use of the electric or high-efficiency gas equipment is extended to some of the buildings which are borderline cases, the increased investment costs are not recovered through improved fuel economy. Moreover, the total natural gas consumption in Alternatives 3, 4a and 4b does not decrease more than 6.3% from the gas consumed in the baseline option, Alternative 1.

In Alternative 3, there is an additional penalty with the cost of electricity being nearly 3.5 times the cost of natural gas, not including the extra demand charge. It is this demand charge, however, that significantly limits the use of electric powered equipment. In the summer, it is certain that any increase in load will result in an increase in the peak load because the air conditioning chillers will also be in use. This higher peak load will then be used to determine the demand charge for the month. In the Army Corps of Engineers Technical Manual 5-810-5, paragraph 4-4.c.2 acknowledges this cost of electricity and states that "because of the high operating cost of electrical equipment, electricity is not used for large-volume water heating when natural gas is available." This study has used electric equipment to satisfy only the smaller hot water demands among the buildings to analyze Alternative 3. Extending the use of electric equipment to the larger demand buildings yields even less desirable results.

The second, and perhaps most significant reason for the small variance in the results, is that a considerable portion of the savings in each of the alternatives resulted from a reduction in the operations and maintenance costs associated with the Central Boiler Plant, Building 447. The costs used to determine these savings were based on fiscal year 1991, and amount to approximately 80%

of the $461,035 of anticipated (first year) total annual savings. It should be recognized that the change over from fuel oil to natural gas took place in October 1990, and that part of the year may have non-routine service and maintenance costs included. While the savings calculations have included central plant operations costs as an item of savings, maintenance and repair costs of the central boiler plant and the extensive distribution system, including any of the "non-routine" services, are not considered as savings under any of the proposed alternatives. The maintenance and repair work will still be required on an annual basis in order to provide an operational central heating system for the following winter.

The direct energy savings shown in Table 1 for each alternative are the combined results of three factors. First, all of the alternatives benefit from a direct energy savings of over 50% at the points-of-use in the buildings. As verified during the field investigations, most of the higher energy using buildings have, within the past 15 years, switched to instantaneous type domestic water heating equipment and have been provided with little or no hot water storage capacity. This approach to satisfying a hot water demand does not consider that a duration of peak use will be followed by an extended period of low use, and consequently, an opportunity for balanced recovery. Thus, instantaneous equipment allows for a peak condition to be satisfied indefinitely and does not encourage users to be energy efficient. Current Army Technical manual 5-810-5 provides for sizing equipment using storage capacity and takes durations of peak use into consideration. This practice leads to equipment of significantly smaller capacities and will not allow for misuse of hot water.

The second factor leading to direct energy savings is that most of the buildings are using hot water at 120°F to 140°F. Presently, Army regulations provide for a temperature of 95°F at the point of use for general domestic washing applications. The calculations for this study use storage tank temperatures of 100°F to 110°F. Applications that require elevated temperatures, such as dishwashing, use local temperature boosting equipment which is generally steam fired.

The third factor is the difference in the cost of natural gas for standard and interruptible services. The central boiler plant qualifies for the lower interruptible rate (approximately 60% of the normal service rate) because the equipment is able to be fired with fuel oil as well, according to the utility

company Washington Gas, regardless of any on-site oil reserves. It is an assumption of this study that the local boilers and water heaters would not be provided with the capability of burning fuel oil and thus will not be able to benefit from the much lower interruptible service gas rate. Though environmental regulations may, in the future, provide clean burning gas suppliers an arm to leverage higher interruptible service rates to users who could burn heavier fuel oils, Washington Gas is not forecasting this increase. This study assumes only standard trends as stipulated in the recent ECIP criteria will affect fuel prices. The remaining price difference between the services is accounted for by using an adjusted or "penalized" rate in calculating the cost savings resulting from lower natural gas usage of the various alternatives.

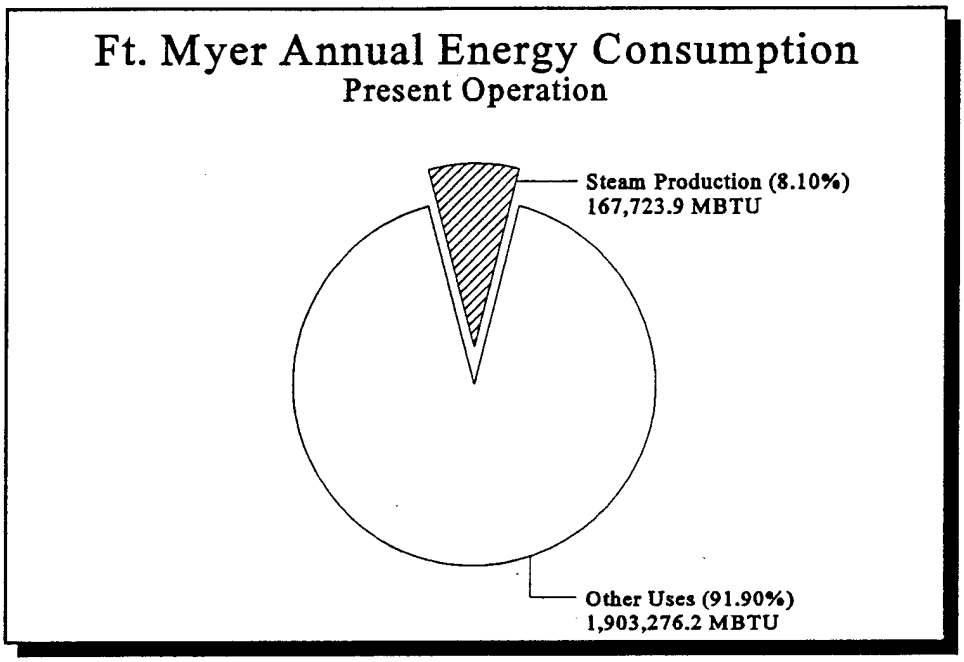
A final consideration in analyzing the energy savings is that the central steam distribution system is aging as indicated by leaks, malfunctioning valves, and deteriorating insulation and bare pipes. Using local steam equipment avoids these energy losses, and also provides a period to address maintenance needs on a scheduled basis to prepare the system for use during the winter months. The steam distribution systems within the buildings surveyed appears to be sufficiently tight and does not contribute significantly to the loss of steam from the central system. However, the steam presses in the barracks buildings would remain as a point-of-use steam loss for all of the alternatives considered.

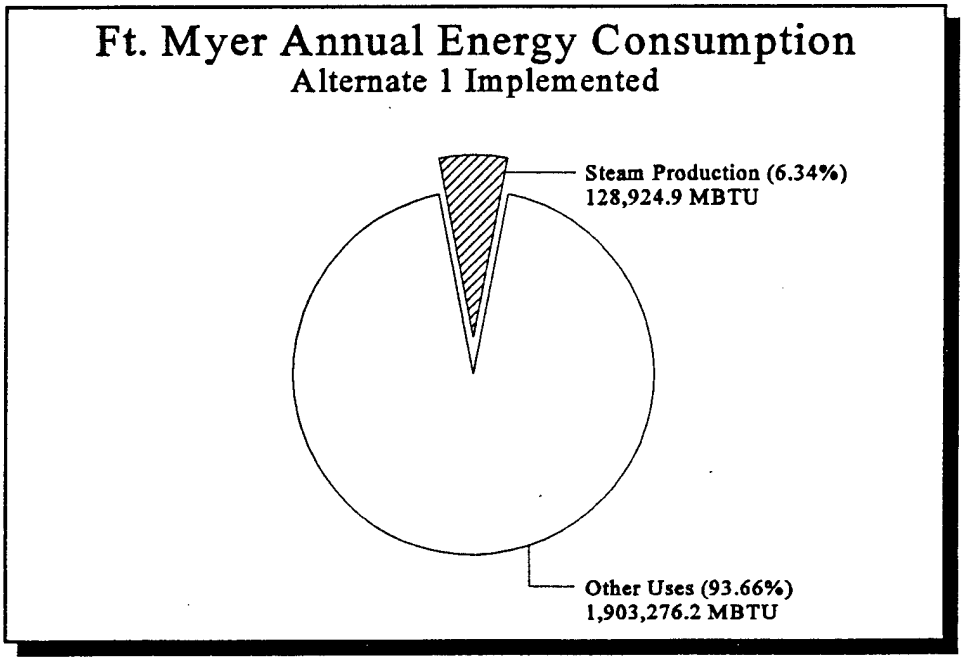
This analysis has shown that Alternatives 1 and 2 are the most favorable in meeting the ECIP program criteria and would have economic benefits if implemented. Because there is little or no economic difference between Alternatives 1 and 2, Alternative 1 is recommended as a more flexible and more aesthetically pleasing alternative. In Alternative 2, the semi-central boiler system serving the "Old Guard" barracks was analyzed with the provision of two boilers to be operated in a back-up or redundant fashion. If the barracks were to depend on one boiler for their entire needs, there would be a greater chance of a breakdown affecting all of these barracks than with an independent boiler for each building as provided in Alternative 1. Therefore, to yield an accurate comparison, only viable installations could be considered. In addition, Alternative 2 provides for a separate structure which would be located behind the "Old Guard" buildings. This could detract from the appearance of the base from the outside (Arlington Boulevard exposure), and would limit any future

use of this space. The areas under consideration are presently used for parking, access to the buildings, and various training exercises by the "Old Guard" companies.

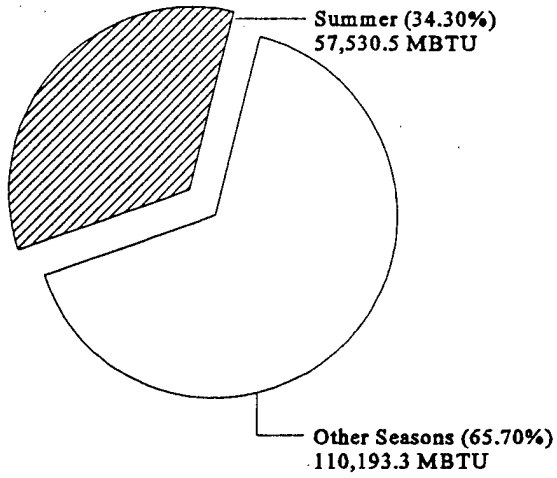
3. ENERGY CONSUMPTIONS AND SAVINGS

The following figures present the estimated basewide energy usage patterns before and after the implementation of Alternative 1; providing an individual gas fired boiler or domestic water heater, as applicable, in each building currently served by the central steam plant during the summer period.

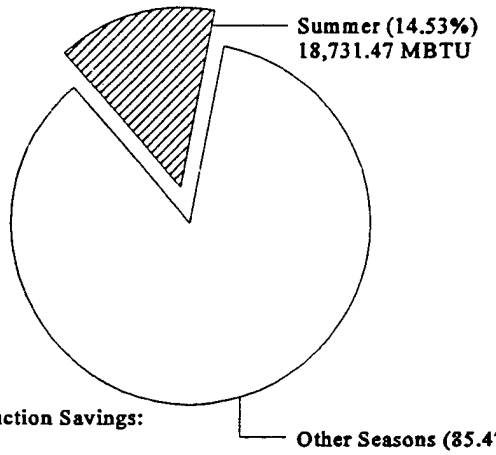




Seasonal Steam Production Energy Usage
Present Operation



Seasonal Steam Production Energy Usage
Alternate 1 Implemented



Annual Steam Production Savings:
$461,035 (21.7%) *
*** Includes Operations Costs**

4. ENERGY PLAN

The Energy Conservation Investment Program (ECIP) is available for the energy conservation opportunity (ECO) analyzed in this report. ECIP funding can apply to projects which have a construction cost estimate greater than $300,000, a savings to investment ratio (SIR) greater than 1.25 and a simple payback period of ten years or less. ECIP projects are also assessed a level of risk associated with continuity of the base mission and stability of the baseline energy consumption used in the analysis calculations.

The services provided by Fort Myer are expected to be required throughout the foreseeable long term. Accordingly, it is also expected that the energy baseline used in the preparation of this analysis will remain stable for the period of the savings calculation.

ECIP Analysis Summary Sheets

Costs of Central Boiler Plant

Savings Over Present Costs

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: Fort Myer, Virginia REGION: 3 PROJECT NO.: DACA 31-89-C-0198
PROJECT TITLE: Fort Myer Summer Steam Shut Down - EEAP FISCAL YEAR: 1994
DISCRETE PORTION NAME: ALTERNATIVE 1
ANALYSIS DATE: March 1994 ECONOMIC LIFE (YR 20 PREPARER: KMS

1. INVESTMENT COSTS:

A.	CONSTRUCTION COST	$ 852,000		
B.	SIOH	$ 51,120		
C.	DESIGN COST	$ 51,120		
D.	TOTAL COST (1A+1B+1C)	$ 954,240		
E.	SALVAGE VALUE OF EXISTING EQUIPMENT		$0.00	
F.	PUBLIC UTILITY COMPANY REBATE		$0.00	
G.	TOTAL INVESTMENT (1D-1E-1F)			$954,240

2. ENERGY SAVINGS (+)/COST(-):

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS- Oct 1992

	ENERGY SOURCE	COST $/MBTU(1)	SAVING(S) MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A.	ELEC	$14.37	249.4	$ 3,584	14.65	$ 52,504
B.	DIST			$ 0		$ 0
C.	RESID	$4.76	14,908.9	$ 70,966	20.99	$ 1,489,584
D.	NG	$1.90 *	23,640.8	$ 44,918	20.60	$ 925,301
E.	PPG			$ 0		$ 0
F.	COAL			$ 0		$ 0
G.	SOLAR			$ 0		$ 0
H.	GEOTH			$ 0		$ 0
I.	BIOMA			$ 0		$ 0
J.	REFUS			$ 0		$ 0
K.	WIND			$ 0		$ 0
L.	OTHER			$ 0		$ 0
M.	DEMAND SAVINGS			$ 0		$ 0
N.	TOTAL		38,799	$ 119,468		$ 2,467,389

3. NON ENERGY SAVINGS (+) OR COST (-):

A.	ANNUAL RECURRING (+/-)	$341,567	
(1)	DISCOUNT FACTOR (TABLE A)	13.59	
(2)	DISCOUNTED SAVINGS/COST (3A X 3A1)		$4,641,896

B. NON RECURRING SAVINGS (+) OR COST (-)

	ITEM	SAVINGS(+) COST(-)(1)	YEAR OF OCCUR. (2)	DISCOUNT FACTOR(3)	DISCOUNTED SAVINGS(+)COST(-)(4)
a.		$ 0		0.000	$ 0
b.		$ 0		0.000	$ 0
c.		$ 0		0.000	$ 0
d.	TOTAL	0			$ 0

C.	TOTAL NON ENERGY DISCOUNTED SAVINGS (3A2+3Bd4)	$4,641,896
4.	SIMPLE PAYBACK 1G/(2N3+3A+(3Bd1/ECONOMIC LIFE)):	2.07 YEARS
5.	TOTAL NET DISCOUNTED SAVINGS (2N5+3C):	$7,109,284
6.	SAVINGS TO INVESTMENT RATION (SIR) 5/1G:	7.45
7.	ADJUSTED INTERNAL RATE OF RETURN (AIRR):	10.99%

* Natural gas rate is adjusted to account for the difference between interruptible service rate and standard service rate. (See "Savings" calculation sheets 2 of 11 and 3 of 11)

August 1985

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Applications
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ENGINEERING ANALYSIS

Sheet 1 of 6

By: K. SCHRAM

COSTS OF EXISTING BOILER PLANT

Project: SUMMER STEAM SHUT DOWN STUDY, FT. MYER Date: 21 DEC 92

Contract No.: DACA 31-89-C-0198 Project No.: 92002.00

COST DATA FROM BOB HENNESSEE, UTILITIES SALES OFFICER, FORT MYER.

FISCAL YEAR 1991:

FUEL GAS COST: $571,271 ($0.43 PER THERM)
FUEL GAS CONSUMED: 1,328,537 THERMS (1.33×10^{11} BTU)

FUEL OIL COST: $236,823
FUEL OIL CONSUMED: 234,454 GAL (3.40×10^{10} BTU)

ESTIMATED ELECTRIC COST: $9,915 (4.675¢/KWH)
(FROM B. HENNESSEE 11/24/92) [212,086 KWH] AVERAGED RATE FOR ELECTRICITY

PLANT MAINTENANCE & REPAIR: $64,823

PLANT OPERATIONS COST: $897,341

STEAM DISTRIBUTION MAINTENANCE & REPAIR: $356,062

TOTAL STEAM PRODUCED: 1.54×10^8 LBS (1.37×10^{11} Btu)
PLANT EFFICIENCY = 0.82 (NON-ADJUSTED)
h_{STEAM} 100 PSI = 888.2 BTU/LB

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ENGINEERING ANALYSIS

By: K. SCHRAM

COSTS OF EXISTING BOILER PLANT

Project: SUMMER STEAM SHUT DOWN STUDY, FT. MYER Date: 21 DEC 92

Contract No.: DACA 31-89-C-0198 Project No.: 92002.00

FISCAL YEAR 1991 : (CONTINUED)

MAKE-UP WATER: THE BASE IS NOT CHARGED FOR WATER PER AN AGREEMENT FOR CORPS OF ENGINEERS PUMP STATION CONSTRUCTION. ⇒ $0

(DALECARLIA PUMP STATION N.W., WASHINGTON) →

SEWER CHARGES: BASE IS CHARGED $2.41/1000 GAL

FROM BOILER PLANT LOGS, MAY 15TH - OCT 15TH
MAKE-UP WATER USE = 3,212,400 GALLONS
-OR- (20,860 GPD)

MAKE-UP WATER PERCENTAGE:

(WATER @ 200°F)

$$(3{,}212{,}400\ \text{gal})\left(7.99\ \frac{\text{lb}}{\text{gal}}\right) = 25{,}682{,}021\ \text{lbs}$$

TOTAL SUMMER STEAM PRODUCTION = 48,351,116 lbs

$$\frac{25{,}682{,}021\ \text{lbs}}{48{,}351{,}116\ \text{lbs}} = \boxed{53\%}$$

∴ 53% non-returned condensate due to leaks & use.

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ENGINEERING ANALYSIS

By: K. SCHRAM

COSTS OF EXISTING BOILER PLANT

Project: SUMMER STEAM SHUT DOWN STUDY, FT. MYER Date: 21 DEC 92

Contract No.: DACA 31-89-C-0198 Project No.: 92002.00

Summer Steam Production: May 15, 1991 to October 15, 1991
(data from Facilities Engineering Log)

	Steam Produced		Gas Consumed		Oil Consumed	
May	5,321,541	pounds	6,120,000	cu.ft.	0	gallons
June	9,933,642	pounds	11,350,000	cu.ft.	0	gallons
July	10,154,109	pounds	11,750,000	cu.ft.	0	gallons
August	9,851,337	pounds	11,040,000	cu.ft.	0	gallons
September	8,803,767	pounds	2,060,000	cu.ft.	63,850	gallons
October	4,286,720	pounds	0	cu.ft.	38,970	gallons
Total =	48,351,116	pounds	42,320,000	cu.ft.	102,820	gallons

Production by Gas:	37,036,046
Percentage by Gas:	76.60%
Heating Value of Gas:	1,000 BTU/cu.ft.
Boiler Efficiency:	82.00%
Plant Efficiency:	77.01%

Production by Oil:	11,315,070
Percentage by Oil:	23.40%
Heating Value of Oil:	145,000 BTU/gallon
Boiler Efficiency:	71.11%
Plant Efficiency:	66.79%

Engineering
Applications
Consultants

ENGINEERING ANALYSIS

Sheet 4 of 16

By: K. SCHRAM

COSTS OF EXISTING BOILER PLANT

Project: SUMMER STEAM SHUT DOWN STUDY, FT. MYER Date: 21 DEC 92

Contract No.: DACA 31-89-C-0198 Project No.: 92002.00

SUMMER COSTS: FY91

SUMMER FUEL GAS USAGE = 42,320,000 ft^3

= 423,200 THERMS (42,320 x 10^6 BTU)

(@ $0.43/THERM) = $181,976

SUMMER FUEL OIL USAGE = 102,820 GALLONS (14,908.9 x 10^6 BTU)

(@ $0.99/GAL) = $101,792

SUMMER ELECTRIC USAGE = $\left(\frac{5 \text{ MONTHS}}{12 \text{ MONTHS}}\right)$ 212,086 KWH

= 88,369 KWH (301.603 x 10^6 BTU)

$4,131

(SUMMER)

PLANT MAINTENANCE & REPAIR: $\left(\frac{5 \text{ mo.}}{12 \text{ mo.}}\right)$ $64,823 = $27,010

(SUMMER)

PLANT OPERATIONS COST: $\left(\frac{5 \text{ mo.}}{12 \text{ mo}}\right)$ $897,341 = $373,892

SUMMER DISTRICUTION SYSTEM M&R = $\left(\frac{5 \text{ mo.}}{12 \text{ mo}}\right)$ $356,062

= $148,359

SEWER CHARGES = $\left(\frac{3,212,400 \text{ GAL}}{1000 \text{ GAL}}\right)\left(\frac{\$2.41}{1000 \text{ gal}}\right)$ = $7,742

Domestic Hot Water & Steam Energy Usage (Present Operation)

Building Number	Utilization	Domestic Hot Water Heating			Other Requirements			Total Summer Heat Demand (MBTU)
		Peak Demand (kBTU/hr)	Use (hrs/wk)	Summer Heat (MBTU)	Peak Demand (kBTU/hr)	Use (hrs/wk)	Summer Heat (MBTU)	
246	Enlisted Barracks	7,800.0	20.4	3,505.79	108.8	57.7	138.14	3,643.93
247	Enlisted Barracks	1,985.5	36.4	1,591.30	100.4	57.7	127.51	1,718.81
248	Enlisted Barracks	3,970.0	20.4	1,784.36	209.2	57.7	265.65	2,050.01
249	Enlisted Barracks	183.3	36.4	146.91	0.0	---	0.00	146.91
250	Enlisted Barracks	2,245.2	36.4	1,799.44	66.9	57.7	85.01	1,884.45
251	Enlisted Barracks	720.8	36.4	577.69	100.4	57.7	127.51	705.20
400	Band	300.0	39.4	260.11	467.0	*	1,122.88	1,382.99
402	Enlisted Barracks	4,000.0	20.4	1,797.84	66.9	57.7	85.01	1,882.85
403	Enlisted Barracks	4,950.0	20.4	2,224.83	0.0	---	0.00	2,224.83
404	Dining Facility	7,500.0	28.5	4,699.20	2,178.2	52.5	2,515.82	7,215.02
405	Recreation Center	91.7	52.9	106.78	0.0	---	0.00	106.78
406	Enlisted Barracks	4,950.0	20.4	2,224.83	0.0	---	0.00	2,224.83
407	NCO Club	835.0	52.9	972.32	0.0	---	0.00	972.32
410	Enlisted Barracks	990.0	36.4	793.45	33.5	57.7	42.54	835.99
411	Bowling Center	91.5	52.9	106.55	0.0	---	0.00	106.55
416	Enlisted Barracks	525.0	36.4	420.77	0.0	---	0.00	420.77
423	Commissary	398.9	39.4	345.85	0.0	---	0.00	345.85
450	Main Exchange	160.0	39.4	138.72	0.0	---	0.00	138.72
452	PX Service Station	0.0	---	0.00	0.0	---	0.00	0.00
469	Child Care Center	387.9	45.3	386.84	0.0	---	0.00	386.84
501	Tencza Terrace	3,600.0	28.7	2,272.25	0.0	---	0.00	2,272.25
525	Rader Clinic	1,350.0	39.4	1,170.48	1,272.7	*	98.87	1,269.34
						Grand Total Summer Demand =		31,935.22

* Use of reheat energy determined through separate Hourly Analysis computation

THIS COMPUTATION IS REPRINTED FROM "SUMMER ENERGY DEMANDS & CONSUMPTION" CALCULATION SECTION OF THIS VOLUME. (PAGE 7 of 17)

Peak Equipment Requirements (Present Operation)

Building Number	Utilization	Domestic Hot Water Heating			Other Requirements			Total Peak Requirement
		Heat (kBTU/hr)	Steam (psig)	Steam (lbs/hr)	Heat (kBTU/hr)	Steam (psig)	Steam (lbs/hr)	(kBTU/hr)
246	Enlisted Barracks	7,800.0	10	8,552	108.8	85	121	7,909
247	Enlisted Barracks	1,985.5	11	2,090	100.4	85	112	2,086
248	Enlisted Barracks	3,970.0	11	4,179	209.2	85	232	4,179
249	Enlisted Barracks	183.3	8	192	0.0	---	0	183
250	Enlisted Barracks	2,245.2	8	2,351	66.9	85	74	2,312
251	Enlisted Barracks	720.8	8	755	100.4	85	112	821
400	Band	300.0	8	315	467.0	8	486	767
402	Enlisted Barracks	4,000.0	20	4,255	66.9	85	74	4,067
403	Enlisted Barracks	4,950.0	20	5,266	0.0	---	0	4,950
404	Dining Facility	7,500.0	10	7,895	2,178.2	15	2,305	9,678
405	Recreation Center	91.7	10	97	0.0	---	0	92
406	Enlisted Barracks	4,950.0	20	5,266	0.0	---	0	4,950
407	NCO Club	835.0	10	879	0.0	---	0	835
410	Enlisted Barracks	990.0	10	1,042	33.5	85	37	1,024
411	Bowling Center	91.5	7	96	0.0	---	0	92
416	Enlisted Barracks	525.0	10	551	0.0	---	0	525
423	Commissary	398.9	10	419	0.0	---	0	399
450	Main Exchange	160.0	10	168	0.0	---	0	160
452	PX Service Station	0.0	---	0	0.0	---	0	0
469	Child Care Center	387.9	8	402	0.0	---	0	388
501	Tencza Terrace	3,600.0	15	3,810	0.0	---	0	3,600
525	Rader Clinic	1,350.0	8	1,414	1,272.7	8	1,326	2,623
							Grand Total =	51,639

THIS COMPUTATION IS REPRINTED FROM "SUMMER ENERGY DEMANDS & CONSUMPTION" CALCULATION SECTION OF THIS VOLUME. (PAGE 17 OF 17)

Engineering
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ENGINEERING ANALYSIS

By: K. SCHRAM

SAVINGS OVER PRESENT COSTS

★(ALL PAGES REVISED 15 MARCH 1994)

Project: SUMMER STEAM SHUT DOWN STUDY, FT. MYER Date: 21 DEC 92

Contract No.: DACA 31-89-C-0198 Project No.: 92002.00

EXISTING PLANT: (UNITS: YEAR = SUMMER PERIOD)

ELECTRIC: 301.603 MBTU/YEAR

OIL: 14,908.9 MBTU/YEAR

NATURAL GAS: 42,320 MBTU/YEAR

NON-ENERGY ANNUAL COSTS:

PLANT M&R = $27,010
PLANT OPERATIONS = $373,892
WATER CHARGES = $0
SEWER CHARGES = $7,742
DISTRIBUTION M&R = $148,359

SUB-TOTAL = $557,003

→ HOWEVER, ALL MAINTENANCE AND REPAIR OPERATIONS WILL TAKE PLACE EVEN IF CENTRAL FACILITY SUMMER SHUT-DOWN OCCURS. REMOVE PLANT & DISTRIBUTION M&R FROM NON-ENERGY SAVINGS:

$557,003 - $27,010 - $148,359 = **$ 381,634** EXISTING NON-ENERGY ANNUAL COSTS GRAND TOTAL

Engineering
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ENGINEERING ANALYSIS

By: K. SCHRAM

SAVINGS OVER PRESENT COSTS

Project: SUMMER STEAM SHUT DOWN STUDY, FT. MYER Date: 21 DEC 92

Contract No.: DACA 31-89-C-0198 Project No.: 92002.00

FOR COMPARISONS OF NATURAL GAS COSTS, AN ADJUSTED RATE MUST BE USED (FOR ECIP PURPOSES) TO ACCOUNT FOR THE DIFFERENCE BETWEEN THE INTERRUPTABLE SERVICE GAS RATE AND THE NON-INTERRUPTABLE RATE THAT BUILDINGS RUNNING SMALL BOILERS WOULD BE BILLED.

THE ADJUSTED RATE IS DEPENDENT ON BOTH THE BILLED RATE AND THE QUANTITY OF GAS CONSUMED FOR EACH SERVICE.

SUBSCRIPT "i" = INTERRUPTABLE

SUBSCRIPT "n" = NON-INTERRUPTABL

$$\text{SAVINGS} = \text{COST}_i - \text{COST}_n$$

$$\text{SAVINGS} = (\text{RATE})_i (\text{USE})_i - (\text{RATE})_n (\text{USE})_n$$

AND PER ECIP CALCULATIONS, ADJUSTED RATE $R = \dfrac{\text{SAVINGS}}{(\text{USE})_i - (\text{USE})_n}$

$$\therefore\ R[(\text{USE})_i - (\text{USE})_n] = (\text{RATE})_i (\text{USE})_i - (\text{RATE})_n (\text{USE})_n$$

$$\boxed{R = \frac{[(\text{RATE})_i (\text{USE})_i - (\text{RATE})_n (\text{USE})_n]}{(\text{USE})_i - (\text{USE})_n}}$$

$(\text{RATE})_i = \$3.80/\text{MBTU}$

$(\text{RATE})_n = \$6.20/\text{MBTU}$

Engineering
Applications
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ENGINEERING ANALYSIS

By: K. SCHRAM

SAVINGS

Project: SUMMER STEAM SHUT DOWN STUDY FT. MYER Date: 21 DEC 92 ★

Contract No.: DACA 31-89-C-0198 Project No.: 92002.00

ALTERNATIVE 1:

ELECTRIC: EXISTING PLANT = 301.603 MBTU/YEAR
ALTERNATIVE 1 = 52.23 MBTU/YEAR
SAVINGS = 249.373 MBTU/YEAR

OIL: EXISTING PLANT = 14,908.9 MBTU/YEAR
ALTERNATIVE 1 = 0 MBTU/YEAR
SAVINGS = 14,908.9 MBTU/YEAR

NATURAL GAS: EXISTING PLANT = 42,320.0 MBTU/YEAR
ALTERNATIVE 1 = 18,679.24 MBTU/YEAR
SAVINGS = 23,640.76 MBTU/YEAR

ADJUSTED GAS RATE: $\frac{(3.8)(42,320)-(6.2)(18,679)}{42,320-18,679} = \$1.904/\text{MBTU}$

NON-ENERGY ANNUAL COSTS:

DATA PROVIDED BY FT. MYER OPERATIONS AND MAINTENANCE PERSONNEL ON THE FOLLOWING 3 PAGES.

E S T I M A T E

O & M Costs of Proposed Individual Boilers/Water Heaters

RE: Summer Steam Study
Ft. Myer, VA
EAC Proj. No. 92002.00

PROPOSED EQUIPMENT:

DOMESTIC HOT WATER HEATERS: (Nat Gas w/ Powered Burner)

Bldg. No.	Energy Requirement (kBTU/hr)	Storage (gals)	Recovery (GPH)	Operational Visits	Off-Season Overhaul
249	80.8	141	161.5	1/month	1/yr
402	545.6	952	1,091.3	1/month	1/yr
405	31.1	53	1,636.9	1/month	1/yr
407	173.3	267	346.7	1/month	1/yr
411	54.2	173	108.3	1/month	1/yr
416	288.1	503	576.2	1/month	1/yr
423	180.0	360	360	1/month	1/yr
450	131.9	422	263.9	1/month	1/yr
469	288.1	250	250	1/month	1/yr

LOW PRESSURE STEAM BOILERS (Nat Gas Fired):

Bldg. No.	Energy Requirement (kBTU/hr)	Operational Visits	Boiler Water Treatment	Off-Season Overhaul
400	583.7	1/week	3/week	1/yr
403	818.5	1/week	3/week	1/yr
404	3,478.2	1/week	3/week	1/yr
406	818.5	1/week	3/week	1/yr
501	2,000.0	1/week	3/week	1/yr
525	1,708.3	1/week	3/week	1/yr

HIGH PRESSURE STEAM BOILERS (Nat Gas Fired):

Bldg. No.	Energy Requirement (kBTU/hr)	Operational Visits	Boiler Wtr Treatment	Off-Season Overhaul	Boiler Inspection
246	597.7	1/day	3/week	1/yr	2/yr
247	227.0	1/day	3/week	1/yr	2/yr
248	394.7	1/day	3/week	1/yr	2/yr
250	248.1	1/day	3/week	1/yr	2/yr
251	362.3	1/day	3/week	1/yr	2/yr
410	220.0	1/day	3/week	1/yr	2/yr

BASIS FOR ESTIMATE:

1. Operational period for the utilization of proposed individual boilers/water heaters are based on six (6) months per year (May - Oct).

2. O & M manpower requirements enunciated are based on projections provided by the Ft. Myer Heating Shop (Mr. Wm. A. WOLFE, Foreman). Fort Myer requirements meet or exceed requirements prescribed in AR420-49.

3. Shop manhour cost are FY "93 data.

4. Other cost figures are based on FY "93 data or from quotations from local Vendors.

BASIS FOR CALCULATIONS:

1. Operational Visits: .5 manhour per visit

2. Seasonal Overhaul : 8 manhours for boiler size up to 1,000 kBTU/hr.
   12 manhours for boiler size 1,000 - 5,000 kBTU/hr.

3. Water Treatment : .5 hr. per visit X 3/week = 1.5 hrs. per week
   (Includes: Draw sample and test, fill chemical tank, operational check of automatic feeder equip., etc.)

4. Boiler Inspection : "Cold" and "Hot" inspections on Hi Press. Steam Boilers by approved and recognized Insurance Company.
   $265.00 ea. for "Cold". $251.00 ea. for "Hot" = $516.00

5. Material Costs:

   a. Parts and materials associated with performing routine PM functions and annual overhaul (lubricants, filters, gaskets, etc.):

      (1) Dom. Hot Wtr Heaters w/ powered burners: $10,00/yr.

      (2) Low Press. Steam Boilers (forced draft): $40.00/yr

      (3) Hi Press. Steam Boilers (forced draft) : $60.00/yr

6. Chemicals Cost for Boiler Water Treatment:

   Projected costs were derived through consultations w/ Mr. Dave VODVARKA of NUTMEG Technology Inc., New Haven, Connecticut who is currently providing Boiler Water Treatment services for Ft. Myer.

7. Hourly man-hour cost for Ft. Myer Heat Shop: $24.76 per hour.

O & M COST CALCULATIONS WORKSHEET

DOMESTIC HOT WATER HEATERS: (9 ea.)

	Annual Cost
Operational Visits:	
.5 hr ea. X 1/mo X 6 mos = 3 hrs/yr ea. X 9 = 27 hrs/yr X $24.76 =	$ 668.52
Off-season Overhaul:	
2 hrs ea. X 1/yr. = 2 hrs/yr ea. X 9 = 18 hrs/yr X $24.76 ——— =	445.68
PM Materials Cost:	
$10.00/yr ea. X 9 ——— =	90.00

LOW PRESS. STEAM BOILERS: (6 ea.)

Operational Visits:	
.5 hr. ea X 1/wk X 26 wks = 13 hrs/yr ea. X 6 = 78 hrs/yr X 24.76 =	1,931.28
Off-season Overhaul:	
6 hrs. ea X 1/yr = 6 hrs/yr ea. X 6 = 36 hrs/yr X $24.76 ——— =	891.36
Boiler Water Treatment:	
.5 hr/visit X 3/wk = 1.5 hrs ea. X 26 wks = 39 hrs/yr ea X 6 = 234 hrs/yr X $24.76--- =	5,793.84
PM Materials Cost:	
$40.00/yr. ea. X 6 ——— =	240.00

HIGH PRESS. STEAM BOILERS: (6 ea.)

Operational Visits:	
.5 hr ea. X 1/day X 125 days = 62.5 hr/yr ea. X 6 = 375 hrs/yr X $24.76 --=	9,285.00
Off-season Overhaul:	
6 hrs ea. X 1/yr = 6 hrs/yr ea. X 6 = 36 hrs/yr X $24.76 ——— =	891.36
Boiler Water Treartment:	
.5 hr/visit X 3/wk = 1.5 hrs ea. X 26 wks = 39 hrs/yr ea. X 6 = 234 hrs/yr X $24.76 —=	5,793.84
PM Materials Cost:	
$60.00/yr ea. X 6 ——— =	360.00
Boiler Inspection (semi-annual):	
$516.00/yr ea. X 6 ——— =	3,096.00
--Chemicals for Water Treatment:	
Vendor estimated annual requirement for 12 Steam Boilers: =	7,346.00*
TOTAL MAN-HOURS: = 1,038 TOTAL O & M COSTS:	$ 36,832.88
One-time Water Treatment Equipment setup cost for 12 Steam Boilers:	
(Tanks, feeder pumps, etc.) VENDOR QUOTE:	$ 6,528.00*

ESTIMATED BY: Fred K. Oshima
FRED K. OSHIMA (703) 696-3804

* PER TELEPHONE CONVERSATION WITH MR. OSHIMA, 19NOV93, 2:30 PM.

Engineering
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ENGINEERING ANALYSIS

By: K. SCHRAM

SAVINGS

Project: SUMMER STEAM SHUT DOWN STUDY, FT. MYER Date: 21-DEC 92

Contract No.: DACA 31-89-C-0198 Project No.: 92002.00

ALT. 1 CONTINUED :

	EXISTING ($)	ALT. 1 ($)	SAVINGS ($)
PLANT M&R	NO NET SAVINGS (SEE P.1) →		0
PLANT OPERATIONS	373,892	36,833	337,059
WATER CHARGES	0	0	0
* SEWER CHARGES	7,742	3,234	4,508
DISTRIBUTION M&R	NO NET SAVINGS (SEE P.1) →		0
	381,634	40,067	$341,567

* SEWER CHARGES PRORATED BASED ON SUMMER DEMAND

$\frac{13,338.38 \text{ MBTU}}{31,935.22 \text{ MBTU}} = .418 \times \$7,742 = \$3,234$

END OF SAVINGS CALCULATIONS FOR ALTERNATIVE 1.

Construction Cost Estimates

Summaries of Initial Costs

Alternatives 1 and 2

Alternative 3 (Revised Sheets)

Alternative 4 (Revised Sheets)

CONSTRUCTION COST ESTIMATE	PREPARED: March 1994 SHEET 1 of 1
PROJECT: SUMMER STEAM SHUT DOWN STUDY BUILDING: All Buildings LOCATION: FORT MYER, VIRGINIA AE PROJECT NO.: 92002.00 AE: Engineering Applications Consultants, P.C.	CONTRACT NO.: DACA 31-89-C-0198 ESTIMATOR: KS PRELIM: CHECKED BY: VP FINAL: X

PROJECT SUMMARY SHEET: Project Totals & Contingencies

ITEM	BARE COSTS MATERIAL	BARE COSTS LABOR	BARE COSTS TOTAL	TOTAL COST (including O & P)
Alternative 1: Project Totals	$390,361	$84,160	$474,521	$811,872
Contingency to Cost of Consturction: 5%				$40,594
PROJECT GRAND TOTAL (rounded to the nearest $1,000)				$852,000
Alternative 2: Project Totals	$382,052	$108,121	$490,173	$813,235
Contingency to Cost of Consturction: 5%				$40,662
PROJECT GRAND TOTAL (rounded to the nearest $1,000)				$854,000
Alternative 3: Project Totals	$422,108	$86,615	$508,723	$852,565
Contingency to Cost of Consturction: 5%				$42,628
PROJECT GRAND TOTAL (rounded to the nearest $1,000)				$895,000
Alternative 4a: Project Totals	$418,711	$90,133	$508,844	$861,712
Contingency to Cost of Consturction: 5%				$43,086
PROJECT GRAND TOTAL (rounded to the nearest $1,000)				$905,000
Alternative 4b: Project Totals	$410,582	$114,333	$524,915	$863,720
Contingency to Cost of Consturction: 5%				$43,186
PROJECT GRAND TOTAL (rounded to the nearest $1,000)				$907,000

CONSTRUCTION COST ESTIMATE

PREPARED: Dec. 1993 SHEET 1 of 5

PROJECT: SUMMER STEAM SHUT DOWN STUDY
BUILDING: All Buildings
LOCATION: FORT MYER, VIRGINIA
AE PROJECT NO.: 92002.00
AE: Engineering Applications Consultants, P.C.

CONTRACT NO.: DACA 31-89-C-0198

ESTIMATOR: KS PRELIM:
CHECKED BY: VP FINAL: X

PROJECT SUMMARY SHEET: Alternative 1

ITEM	BARE COSTS MATERIAL	BARE COSTS LABOR	BARE COSTS TOTAL	TOTAL COST (including O & P)
Building 246 Enlisted Barracks	24,557	5,206	29,763	43,224
Building 247 Enlisted Barracks	16,631	4,272	20,903	30,495
Building 248 Enlisted Barracks	17,492	4,402	21,894	31,924
Building 249 Enlisted Barracks	2,554	1,272	3,826	5,691
Building 250 Enlisted Barracks	19,346	7,962	27,308	40,370
Building 251 Enlisted Barracks	19,157	5,578	24,735	36,202
Building 400 Band	16,401	4,023	20,424	29,762
Building 402 Enlisted Barracks	25,571	5,350	30,921	44,893
Building 403 Enlisted Barracks	33,828	6,551	40,379	58,528
Building 404 Dining Facility	47,900	9,146	57,046	82,662
Building 405 Recreation Center	4,047	1,141	5,188	7,587
Building 406 Enlisted Barracks	28,315	3,014	31,329	44,949
Building 407 NCO Club	4,180	1,236	5,416	7,930
Building 410 Enlisted Barracks	15,613	3,032	18,645	27,027
Building 411 Bowling Center	2,156	736	2,892	4,251
Building 416 Enlisted Barracks	16,971	3,075	20,046	29,016
Building 423 Commissary --- DELETED				
Building 450 Main Exchange	7,723	1,299	9,022	13,040
Building 452 PX Service Station --- NO SERVI				
Building 469 Child Care Center	4,141	1,286	5,427	7,957
Building 501 Tencza Terrace	51,861	7,838	59,699	86,119
Building 525 Rader Clinic	31,917	7,741	39,658	57,774
Natural Gas Services (by Washington Gas):				
- Services	---	---	---	25,455
- Mains	---	---	---	71,192
- Meters	---	---	---	22,600
- Regulators	---	---	---	3,224
GRAND TOTAL	$390,361	$84,160	$474,521	$811,872

A.O.SMITH

CONSERVATIONIST®

COMMERCIAL GAS TANK-TYPE WATER HEATERS BTP-140 THRU 700

STANDARD FEATURES

Meets ASHRAE 90A-1980 (1982 requirements) and C.E.C. and New York Codes for thermal efficiency and standby loss.

GLASS-LINED TANK – Exclusive corrosion protection with glass-lining and nickelous oxide on all interior surfaces. Multiple anodes provide corrosion protection.

POWER GAS BURNER – Electronic flame monitoring with direct spark ignition (BTP-140 thru BTP-370). Solid state programmed flame safeguard (BTP-540A & BTP-700A). For added safety, all units are equipped with redundant gas valves. Power gas burner requires 120 volt 60Hz service. A NEGATIVE DRAFT is required in the vent piping. This is not a forced draft burner.

FULLY AUTOMATIC CONTROLS – Safety shut off, high temperature limit control, dual thermostat (adjustable 120° F thru 180° F) for accurate temperature control. Maximum inlet gas pressure 14" W.C.

EXTRA DENSITY VERMIN-PROOF GLASS FIBER INSULATION.

JACKET – Is of heavy gauge steel with baked enamel finish over bonderized undercoat.

FULLY CERTIFIED BY A.G.A. (BTP-140 thru BTP-370).

UL CERTIFIED ON BTP - 540A AND 700A.

MEETS ASHRAE, C.E.C. AND N.Y. CODES.

ASME CONSTRUCTION – Standard on BTP-540 & 700, available on BTP-140, BTP-199, BTP-270 & BTP-370. When specifying ASME construction, ADD the letter "A" i.e., BTP-270A.

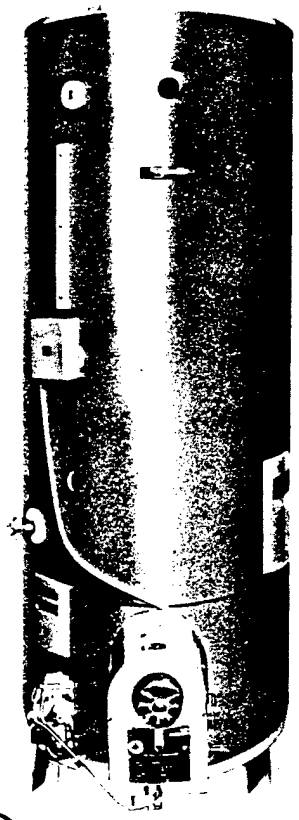
A.G.A./ASME RATED TEMPERATURE & PRESSURE RELIEF VALVE – Factory installed.

BAROMETRIC DRAFT DAMPER – To ensure proper draft for maximum efficiency.

EASY CLEANING – Handhole cleanout(s) allows easy cleaning.

CAUTION: Unit must be installed on non-combustible surface.

PROFESSIONAL STARTUP SERVICE – Furnished to assure most efficient combustion and safe initial operation.



OTHER FEATURES

●Two layers of high temperature ceramic fiber insulation in combustion chamber ●Flame inspection port opening ● Mounted on rugged channel iron skids ● Multiple anodes for protection.

NOTE: Maximum gas inlet pressure 14" W.C.

OPTIONS

● Factory Mutual approved control arrangement ● Illinois School Code ● Industrial Risk Insurance (formerly FIA) control systems - on models over 400,000 BTU ● National Board stamping (ASME heaters only) ● Low water cutoff ● 5 or 10 year extended limited warranty.

ASME

(ON SELECTED MODELS)

Models	Storage Capacity U.S.Gallons	Input Rating BTU/HR. Nat. & Prop.	Recovery Capacity GPH 100°F Rise	Recovery Capacity GPH 140°F Rise	Motor HP 120V 60Hz 1 Phase
BTP-140	86	140,000	136	97	1/40 H.P.
BTP-199	86	199,000	193	138	1.5 Amps.
BTP-270	86	270,000	262	187	1/40 H.P.
*BTP-370	75	370,000	359	256	1.5 Amps
BTP-540A	69	540,000	524	374	1/6 H.P.
BTP-700A	69	650,000	630	450	4.7 Amps

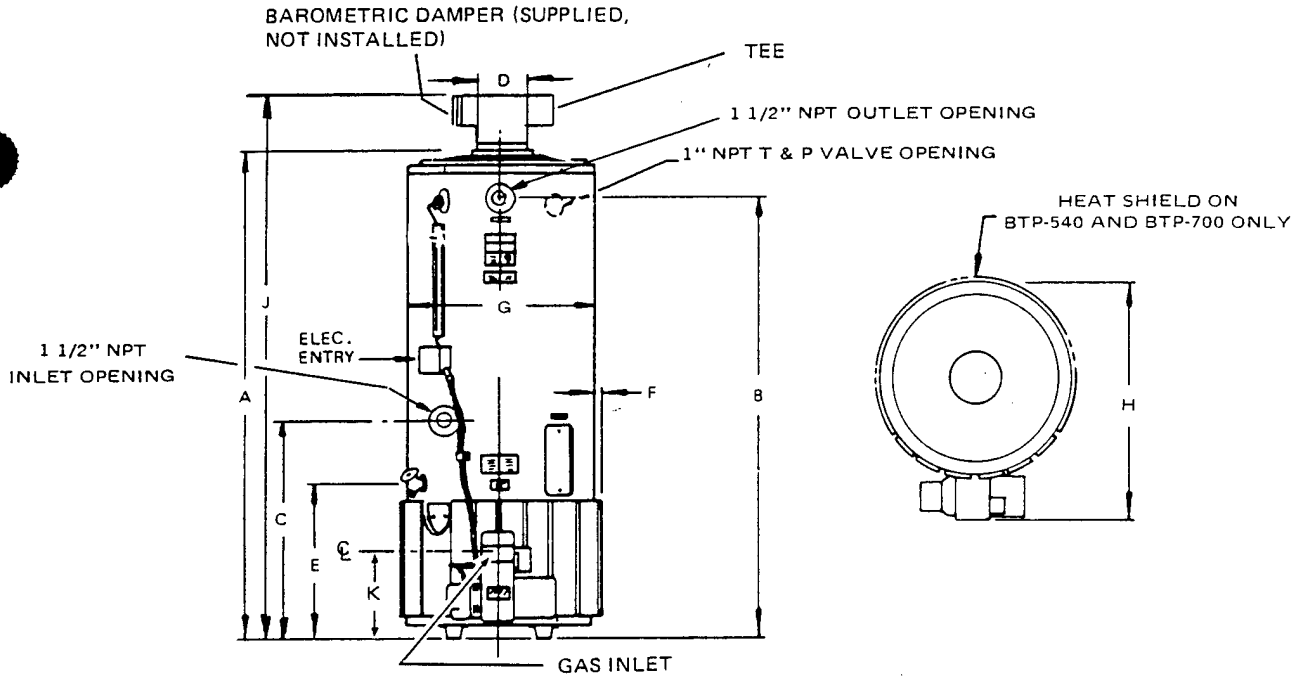
*Natural gas only

Based on 80% Thermal Efficiency.

NOTE: To compensate for the effects of high altitude areas above 2000 feet, recovery capacities should be reduced approximately 4% for every 1000 feet above sea level. Above capacities are based on actual efficiencies obtained in A. O. Smith engineering laboratories.

LIMITED WARRANTY OUTLINE

If the tank should leak any time during the first three years, under the terms of the warranty, A. O. Smith will furnish a replacement heater; installation, labor, handling and local delivery extra. **THIS OUTLINE IS NOT A WARRANTY.** For complete information, consult the written warranty or A. O. Smith Water Products Company.



ALL DIMENSIONS IN INCHES

Models	A	B	C	D	E	F	G	H	J	K	Gas Conn.	Approx. Ship. Wt. Less Burner	Approx. Ship. Wt. Burner Only
BTP-140	74 3/4	67 3/4	27	6	23 1/8	–	27 3/4	38 3/4	85 1/4	22 1/8	1/2	568	30
BTP-199	74 3/4	67 3/4	27	6	23 1/8	–	27 3/4	38 3/4	85 1/4	22 1/8	1/2	568	30
BTP-270	74 3/4	67 3/4	27	8	23 1/8	–	27 3/4	49	87 1/4	22 7/8	3/4	568	50
BTP-370	74 3/4	65	27	8	23 1/8	–	27 3/4	49	87 1/4	22 7/8	3/4	638	50
BTP-540A	79 1/2	70 3/8	25 1/4	9	29 3/8	3/4	27 3/4	49	94	12 9/16	1	739	65
BTP-700A	79 1/2	70 3/8	25 1/4	10	29 3/8	3/4	27 3/4	49	94	12 9/16	1	739	65

BTP SUGGESTED SPECIFICATION

GENERAL

Water heater(s) shall be Model _____ as manufactured by A. O. SMITH or equal. Water heater(s) shall be of glass-lined design and include a powered gas burner with redundant main gas valves, electronic ignition, automatic pilot gas valves, gas pressure regulator, and flame inspection port. Heater(s) shall have an input rating of _____ and a recovery rating of _____ GPH at a temperature rise of 100°F with a maximum storage capacity of _____. Heater(s) shall be equipped with 1-1/2" NPT WATER inlet and outlet openings and (1) 4" handhole cleanout on Models BTP-140 thru BTP-270; (2) 4" handholes on ASME models. Heater(s) shall have a minimum working pressure of 160 psi and include a high temperature limit control, dual thermostat for accurate temperature control and factory installed AGA. T & P valve. Heater(s) shall be equipped with multiple anodes for protection, be insulated with a vermin-proof glass fiber insulation and meet ASHRAE 90A-1980 (1982 requirements) for thermal efficiency and standby loss. The outer jacket shall have a baked enamel finish over a bonderized undercoating. All internal surfaces of the heater(s) exposed to water shall be glass-lined with a alkaline boro-silicate, nickelous oxide composition that has been fused to the steel by firing at a temperature range of 1400°F to 1600°F. Heater(s) tank shall have a 3 year limited warranty against corrosion as outlined in the written warranty.

CONTROLS - BTP-140 thru BTP-370A

Controls shall include a Fenwal 05-16 to provide direct spark ignition and flame monitoring. A prepurge of 30 seconds minimum shall be provided. A trial for ignition period of 5 seconds, after which if the flame is not proved or lost during the running cycle, the system will lock out. System shall include automatic gas valve, main gas pressure regulator, automatic gas shut-off, manual shut-off, and be rated for 14" W.C. maximum gas pressure.

CONTROLS - BTP-540A thru BTP-700A

Controls shall include a solid state electronic safeguard primary control which provides a 2-4 second shutdown in the event of flame failure and a prepurge of the combustion chamber. System shall include pilot and main gas regulators, an automatic gas valve, manual test cock, manual gas shut-off cock, pilot shut-off cock, and pilot solenoid valve. Controls shall be rated for 14" W.C. maximum gas pressure.

A. O. Smith
Water Products Company
Irving, TX
A Division of A. O. Smith Corporation

Printed in U.S.A.

A. O. SMITH
CONSERVATIONIST®

COMMERCIAL GAS TANK TYPE WATER HEATERS

BTP-125-140 thru BTP-125-720
BTP-200-300 thru BTP-200-1500
BTP-300-300 thru BTP-300-1500
BTP-400-600 thru BTP-400-2500
BTP-600-720 thru BTP-600-2500

Meets ASHRAE 90A-1980, 1982 requirements (formerly 90-75) for energy efficiencies.

FEATURES

UL – Entire unit UL listed (File No. MH11631).

GLASS-LINED TANK – Exclusive corrosion protection with glass-lining on all interior surfaces. Multiple anodes provide even more corrosion protection.

ASME CONSTRUCTION STANDARD – 160 PSI working pressure on all models.

POWERED GAS BURNER – Suitable for natural or propane gas. Powered burner has electronic flame safeguard control with intermittent spark ignition. Also included are main and pilot automatic gas valves plus gas pressure regulators, diaphragm air switch for proof of blower operation. Maximum supply gas pressure 11" W.C. A negative draft of –.02" (min.) –.07" W.C. is required in vent piping.

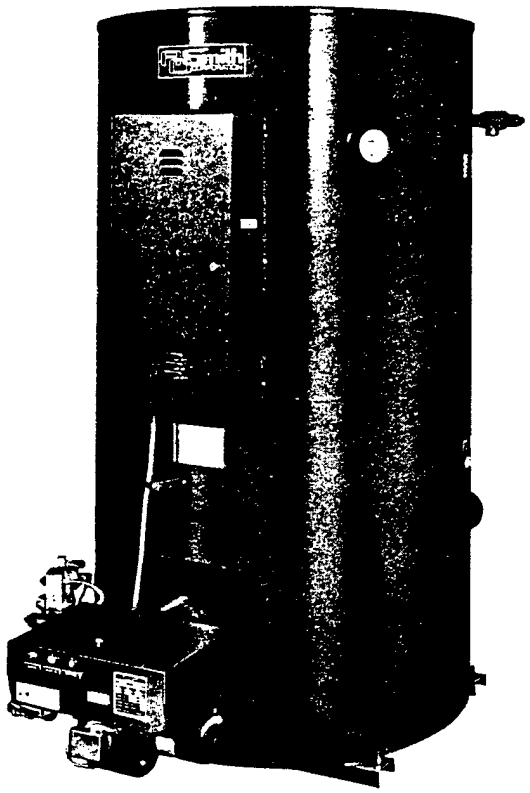
FULLY AUTOMATIC CONTROLS WITH SAFETY SHUTOFF – High temperature limit control (manual reset). ASME rated temperature and pressure relief valve. Hinged door control compartment for ease of access. Two thermostats, upper and lower, for accurate temperature control. Standard control is for 120° - 150°F water service.

JACKET – Heavy gauge steel with baked enamel finish over bonderized undercoat.

PROFESSIONAL START-UP SERVICE FURNISHED TO ASSURE MOST EFFICIENT COMBUSTION AND SAFE INITIAL START-UP. ALL UNITS ARE ALSO 100% TESTED AT FACTORY.

OTHER FEATURES

• Two layers of high temperature ceramic fiber insulation in combustion chamber • Flame inspection port opening • Mounted on rugged channel iron skids • National Board stamping • Combination temperature and pressure gauge • Low water cutoff • ASME rated temperature and pressure relief valve • Barometric draft regulator • Two 4" handhole inspection openings • 120 volt control circuit.



UL ASME

OPTIONS

• Factory Mutual approved control arrangement • Industrial Risk Insurance (formerly FIA) • Illinois School Code control systems • 5 year or 10 year limited warranty • Manifold kit • High or low water pressure switch • 180°F water service thermostats • A.G.A. rated T & P valve • Modular graphic burner systems management on heaters with 270,000 BTU input and over.

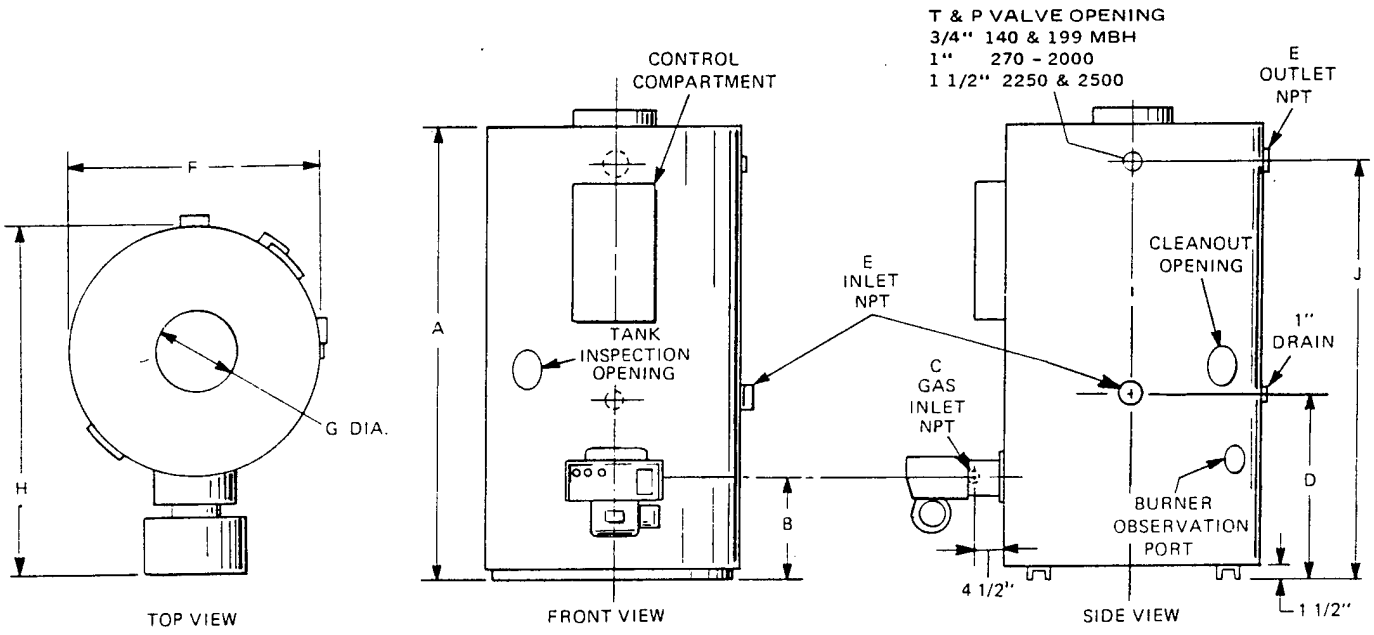
LIMITED WARRANTY OUTLINE

If the tank should leak any time during the first three years, under the terms of the warranty, A. O. Smith will repair or replace heater; installation, labor, handling and local delivery extra. **THIS OUTLINE IS NOT A WARRANTY.** For complete information, consult the written warranty or A. O. Smith Water Products Company.

STORAGE CAPACITIES

Models	Nominal Storage Capacity U.S. Gallons	Input Rating BTU/Hr. Natural Gas	1st Hour Availability	Recovery Capacity GPH 80°F Rise	Recovery Capacity GPH 100°F Rise	Recovery Capacity GPH 140°F Rise	Motor HP 120V 60 Hz 1ø
BTP-125-140*	125	140,000	236	170	136	97	
BTP-125-199*	125	199,000	293	241	193	138	1/15 HP/2.2 Amps
BTP-125-255*	125	255,000	337	309	247	176	
BTP-125-270	125	270,000	362	327	262	187	
BTP-125-400	125	400,000	488	485	387	277	1/4 HP/4.6 Amps
BTP-125-540	125	540,000	624	654	524	374	
BTP-125-720	125	720,000	779	873	698	499	1/3 HP/5.5 Amps
BTP-200-300	200	300,000	451	364	291	208	1/4 HP/4.6 Amps
BTP-200-600	200	600,000	742	727	582	416	
BTP-200-800	200	800,000	936	970	776	554	1/3 HP/5.5 Amps
BTP-200-1000	200	1,000,000	1130	1212	970	693	
BTP-200-1250	200	1,250,000	1372	1515	1212	866	1/2 HP/7.4 Amps
BTP-200-1500	200	1,500,000	1615	1818	1455	1039	
BTP-300-300	300	300,000	451	364	291	208	1/4 HP/4.6 Amps
BTP-300-600	300	600,000	742	727	582	416	
BTP-300-800	300	800,000	936	970	776	554	1/3 HP/5.5 Amps
BTP-300-1000	300	1,000,000	1130	1212	970	693	
BTP-300-1250	300	1,250,000	1372	1515	1212	866	1/2 HP/7.4 Amps
BTP-300-1500	300	1,500,000	1615	1818	1455	1039	
BTP-400-600	400	600,000	902	727	582	416	1/4 HP/4.6 Amps
BTP-400-800	400	800,000	1096	970	776	554	
BTP-400-1000	400	1,000,000	1290	1212	970	693	1/3 HP/5.5 Amps
BTP-400-1250	400	1,250,000	1532	1515	1212	866	
BTP-400-1500	400	1,500,000	1775	1816	1455	1039	
BTP-400-1750	400	1,750,000	2017	2121	1697	1212	1/2 HP/7.4 Amps
BTP-400-2000	400	2,000,000	2259	2424	1939	1385	
BTP-400-2250	400	2,250,000	2502	2727	2182	1558	3/4 HP/10.2 Amps
BTP-400-2500	400	2,500,000	2744	3030	2424	1732	
BTP-600-720	600	720,000	1178	873	698	499	
BTP-600-1000	600	1,000,000	1450	1212	970	693	1/3 HP/5.5 Amps
BTP-600-1250	600	1,250,000	1692	1515	1212	866	
BTP-600-1500	600	1,500,000	1935	1816	1455	1039	
BTP-600-1750	600	1,750,000	2177	2121	1697	1212	1/2 HP/7.4 Amps
BTP-600-2000	600	2,000,000	2419	2424	1939	1385	
BTP-600-2250	600	2,250,000	2662	2727	2182	1558	3/4 HP/10.2 Amps
BTP-600-2500	600	2,500,000	2904	3030	2424	1732	

Capacity ratings are based on 80% thermal efficiency. *Beckett burners.



All Dimensions In Inches

Models	A	B	C	D	E	F	G	H*	J	Ship. Wt. w/Burner (Lbs.)
BTP-125-140	83 1/2	15	1/2	32 1/2	1 1/4	34 1/2	5	46†	73	1280
BTP-125-199	83 1/2	15	1/2	32 1/2	1 1/4	34 1/2	6	46†	73	1280
BTP-125-255	83 1/2	15	1/2	32 1/2	1 1/4	34 1/2	6	46†	73	1280
BTP-125-270	83 1/2	15	1	32 1/2	1 1/4	34 1/2	6	56 1/2	73	1385
BTP-125-400	83 1/2	15	1	32 1/2	1 1/4	34 1/2	7	56 1/2	73	1385
BTP-125-540	83 1/2	15	1	32 1/2	1 1/4	34 1/2	8	56 1/2	73	1485
BTP-125-720	83 1/2	15	1 1/4	32 1/2	1 1/4	34 1/2	10	56 1/2	73	1490
BTP-200-300	83 1/2	15	1	32 1/2	1 1/2	44 3/4	6	66 1/2	73	2098
BTP-200-600	83 1/2	15	1	32 1/2	1 1/2	44 3/4	8	68 1/2	73	2098
BTP-200-800	83 1/2	15	1 1/4	32 1/2	1 1/2	44 3/4	10	66 1/2	73	2103
BTP-200-1000	83 1/2	15	1 1/4	32 1/2	1 1/2	44 3/4	10	66 1/2	73	2103
BTP-200-1250	83 1/2	15	1 1/4	32 1/2	1 1/2	44 3/4	12	66 1/2	73	2467
BTP-200-1500	83 1/2	15	1 1/2	32 1/2	1 1/2	44 3/4	12	81 1/2	73	2757
BTP-300-300	91 1/2	14	1	26 1/2	1 1/2	44 3/4	6	66 1/2	83	2150
BTP-300-600	91 1/2	14	1	26 1/2	1 1/2	44 3/4	8	66 1/2	83	2150
BTP-300-800	91 1/2	14	1 1/4	26 1/2	1 1/2	44 3/4	10	66 1/2	83	2308
BTP-300-1000	91 1/2	14	1 1/4	26 1/2	1 1/2	44 3/4	10	66 1/2	83	2308
BTP-300-1250	91 1/2	14	1 1/4	26 1/2	1 1/2	44 3/4	12	66 1/2	83	2584
BTP-300-1500	91 1/2	14	1 1/2	26 1/2	1 1/2	44 3/4	12	81 1/2	83	2774
BTP-400-600	91 1/2	15	1	32 1/2	2	55	8	76 1/2	81	3207
BTP-400-800	91 1/2	15	1 1/4	32 1/2	2	55	10	76 1/2	81	3212
BTP-400-1000	91 1/2	15	1 1/4	32 1/2	2	55	10	76 1/2	81	3212
BTP-400-1250	91 1/2	15	1 1/4	32 1/2	2	55	12	76 1/2	81	3212
BTP-400-1500	91 1/2	15	1 1/2	32 1/2	2	55	12	91 1/2	81	3402
BTP-400-1750	91 1/2	15	2	32 1/2	2	55	14	91 1/2	81	3528
BTP-400-2000	91 1/2	15	2	32 1/2	2	55	14	91 1/2	81	3669
BTP-400-2250	91 1/2	15	2	32 1/2	2	55	16	91 1/2	81	3886
BTP-400-2500	91 1/2	15	2	32 1/2	2	55	16	91 1/2	81	4169
BTP-600-720	115	15	1 1/4	32 1/2	2	55	10	76 1/2	105	3567
BTP-600-1000	115	15	1 1/4	32 1/2	2	55	10	76 1/2	105	3567
BTP-600-1250	115	15	1 1/4	32 1/2	2	55	12	76 1/2	105	3567
BTP-600-1500	115	15	1 1/2	32 1/2	2	55	12	91 1/2	105	3737
BTP-600-1750	115	15	2	32 1/2	2	55	14	91 1/2	105	3737
BTP-600-2000	115	15	2	32 1/2	2	55	14	91 1/2	105	3737
BTP-600-2250	115	15	2	32 1/2	2	55	16	91 1/2	105	4377
BTP-600-2500	115	15	2	32 1/2	2	55	16	91 1/2	105	4519

*Dimensions Based on "Power Flame" Power Burners. †Dimensions Based on "Beckett" Burners.

BTP SUGGESTED SPECIFICATIONS

Water heater(s) shall be Model _____ as manufactured by the A. O. SMITH Corporation, Water Products Company or equal. Water heater(s) shall be of glass-lined design and include a powered gas burner with electronic flame safeguard, intermittent ignition, main and pilot automatic gas valves, redundant solenoid gas valve, gas pressure regulator, diaphragm air switch for proof of blower operation, and flame inspection port. Maximum supply gas pressure to heater 14" W.C. Heater(s) shall have an input rating of_____ and a recovery rating of_____GPH at a temperature rise of 100°F with a minimum actual storage capacity of_____. Heater(s) shall be equipped with _____ NPT WATER inlet and outlet openings, (2) 4" handhole cleanouts, shall have an ASME working pressure of 160 PSI, and stamped National Board, and listed by Underwriters Laboratories. Controls shall include: high temperature limit control (manual reset), upper and lower thermostats, combination temperature and pressure gauge, low water cutoff, ASME rated temperature and pressure relief valve, and draft regulator. Control compartment door shall be hinged for easy access. The heater(s) shall be equipped with multiple anodes for cathodic protection. The heater(s) shall be insulated with a vermin-proof glass fiber insulation or equal. Heater(s) must meet ASHRAE 90A-1980 (1982 requirements) for recovery efficiency and standby loss. The outer jacket shall have a baked enamel finish over a bonderized undercoating. All internal surfaces of the heater(s) exposed to water shall be glass-lined with a alkaline borosilicate, nickelous oxide composition that has been fused to steel by firing at a temperature range of 1400°F to 1600°F. The glass lining shall be fused to the steel by firing at a temperature range of 1400°F to 1600°F. Heater(s) tank shall have a 3, 5, or 10 year limited warranty against corrosion as outlined in the written warranty. Professional start-up service to be included.

A. O. Smith
Water Products Company
Irving, TX
A Division of A. O. Smith Corporation

Printed in U.S.A.

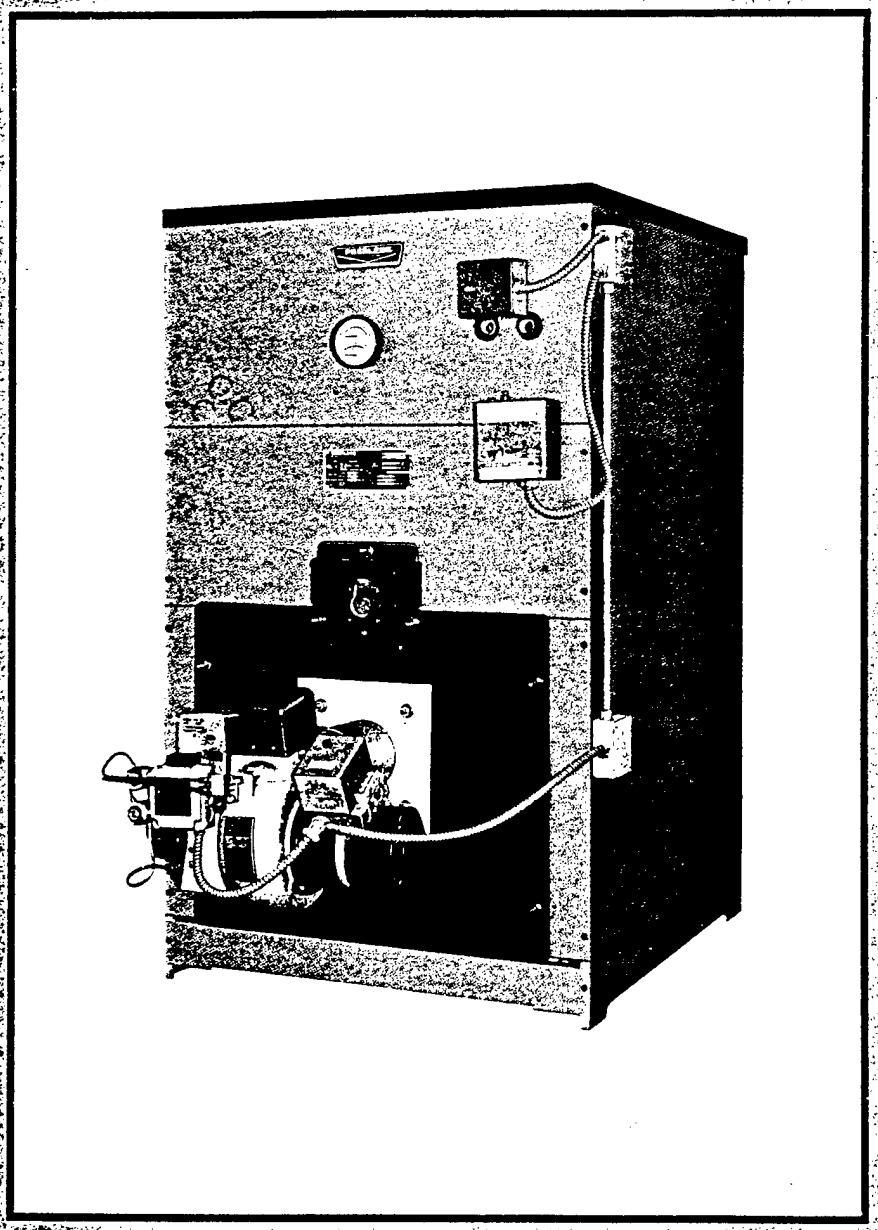
PEERLESS

OF BOYERTOWN, PENNSYLVANIA

SINCE 1908

SERIES 7FDA

PRESSURIZED FOR FORCED DRAFT FIRING



OIL • COMBINATION GAS/OIL or GAS FIRED

INDUSTRIAL/COMMERCIAL

CAST IRON BOILER-BURNER UNITS

21 SIZES

FOR USE WITH HOT WATER OR STEAM SYSTEMS

446,000 to 3,052,000

BTU/hr. Output

I.B.R.®

MEMBER

HYDRONICS INSTITUTE

Castings-Certified by Eastern Foundry Company, Boyertown, PA 19512

Division of Peerless Industries, Inc.

Series 7FDA proven features of Advanced Design and Engineering

1 Heavy gauge aluminized steel flue collector, corrosion resistant for long life, and sealed to sections with Hi-Temp rope.

2 Tankless all copper water heater for abundant year-round domestic hot water supply. Additional coils can be installed for greater hot water requirements. (optional)

3 All steel Jacket, glass wool insulated, with Hammertone green baked enamel finish. Jacket is designed for installation after supply and return piping is connected.

4 The Combination Gas/Oil burner illustrated shows the mounting arrangement. The gas burner is mounted in a similar fashion. The oil burner is flanged on smaller boiler sizes with pedestal added on larger units.

5 Precision ground, cast-on pads evenly space the sections, to eliminate corrosion from long iron to iron contact. Sections are sealed with Hi-Temp rope for complete retention of the hot burning gasses.

6 Hi-Temp rope sealed cast iron clean-out door on front of boiler allows for inspection and easy cleaning of flueways to maintain high boiler efficiency.

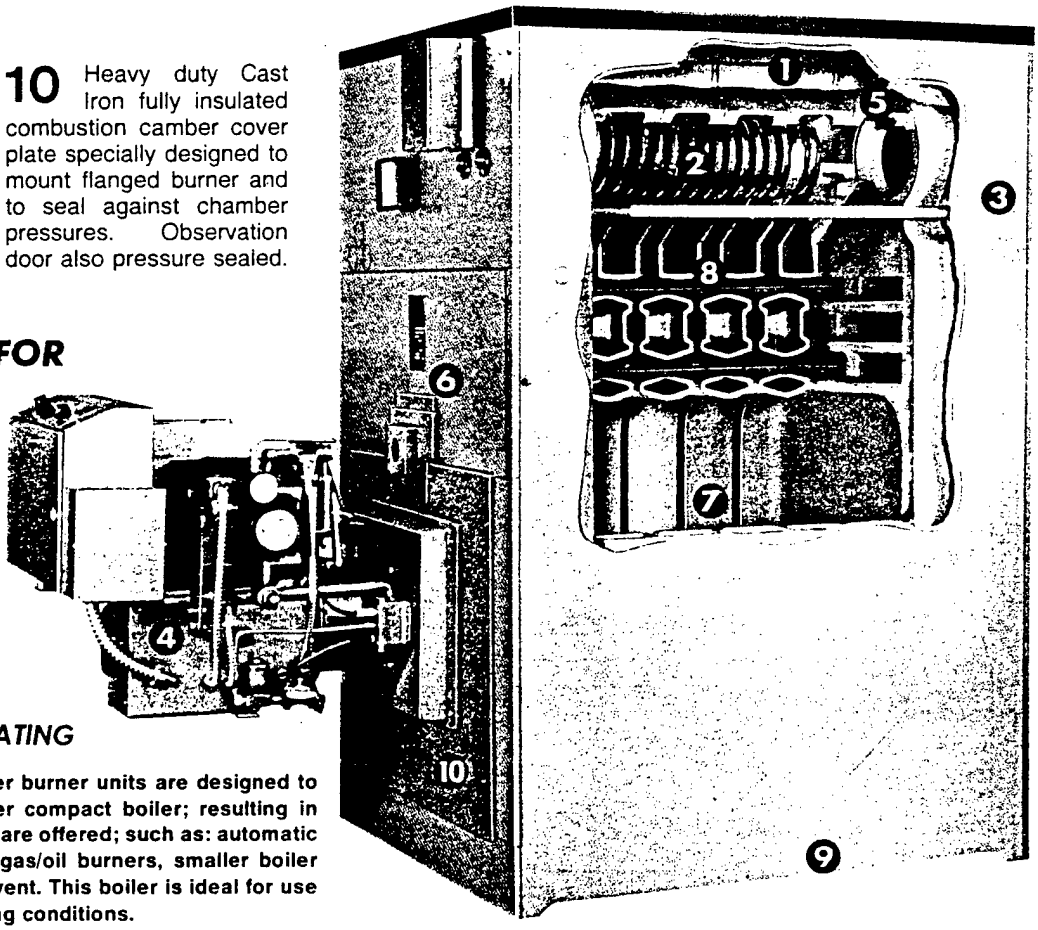
7 Full wet base water tube sections completely surround combustion area for maximum heat adsorption of burning fuel and low floor temperature.

8 The famous Peerless heavy duty cast iron water tube sections, with an extremely high number of gas passages (8 per section), are cast in a closed H design for maximum strength and efficiency.

9 Sturdy base legs cast as part of each section enables boiler to be installed directly on non-combustible floor without the addition of a separate base.

10 Heavy duty Cast Iron fully insulated combustion camber cover plate specially designed to mount flanged burner and to seal against chamber pressures. Observation door also pressure sealed.

PRESSURIZED FOR FORCED DRAFT



ADVANCED HYDRONIC HEATING

The Series 7FDA (Forced Draft) boiler burner units are designed to provide higher output with a smaller compact boiler; resulting in greater efficiency. Many advantages are offered; such as: automatic firing with oil, gas, or combination gas/oil burners, smaller boiler room planning, and low chimney or vent. This boiler is ideal for use when encountering adverse operating conditions.

STRIBUTED BY

Printed in U.S.A. 10-888S

PEERLESS

OF BOYERTOWN, PENNSYLVANIA
SINCE 1908

SERIES 7FDA

OIL • COMBINATION GAS/OIL or GAS FIRED

INDUSTRIAL/COMMERCIAL

CAST IRON BOILER-BURNER UNITS

Castings-Certified by
Eastern Foundry Company,
A Division of Peerless Industries, Inc.
Boyertown, PA 19512

STANDARD EQUIPMENT

	W	WU	S	SU
Cast Iron Water Tube Section				
Wet Base Design ASME 50# W.P.	S	S	S	S
Wet Base Design ASME 80# W.P.	O	O	O	O
Hammertone Insulated Enamel Steel Jacket	S	S	S	S
Forced Draft Burner	—	S	—	S
Combustion Camber Cover Plate, Insulated w/Observation Port	S	S	S	S
Cerafelt Base Liner	S	S	S	S
Hi-Temp Rope Seal	S	S	S	S
Observation Port, Rear Section	S	S	S	S
Front Cleanout Plate	S	S	S	S

	W	WU	S	SU
Aluminized Steel Flue Collector	S	S	S	S
Lock Type Damper	S	S	S	S
Tankless Domestic Water Heater	O	O	O	O
High Limit Manual Reset Aquastat	S	S	—	—
Operating Aquastat	S	S	—	—
Comb. Temperature/Pressure Gauge	S	S	—	—
ASME 30# Safety Relief Valve	S	S	—	—
High Limit Manual Reset Pressuretrol	—	—	S	S
Operating Pressuretrol	—	—	S	S
Steam Pressure Gauge	—	—	S	S
Gauge Glass w/Fittings	—	—	S	S
ASME 15# Side Outlet Pop Safety Valve	—	—	S	S

S (Standard) O (Optional) — (Does not apply)

SERIES 7FDA BOILER RATINGS & VENT SIZES

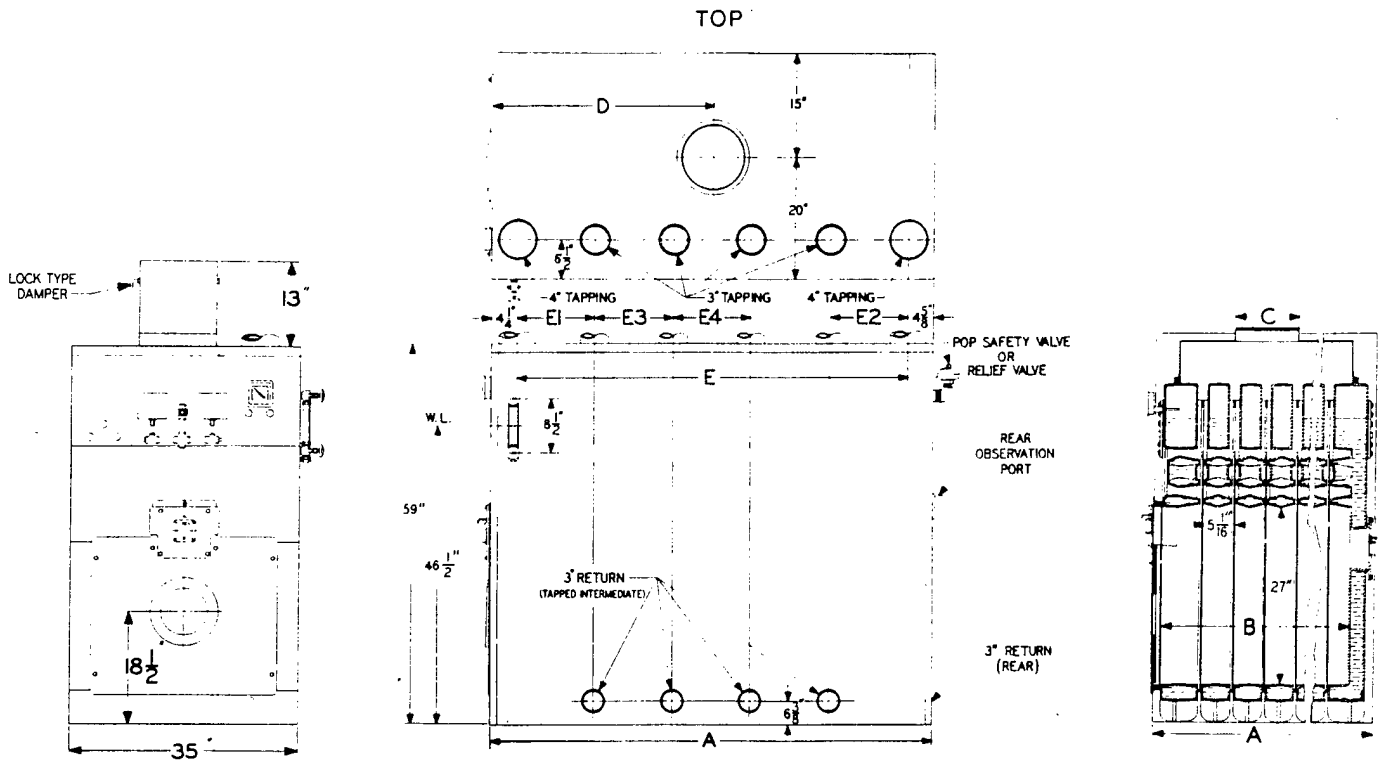
Boiler Burner Unit No.	Gross I=B=R Output M.B.H.	Boiler H.P.	** I=B=R Burner Capacity Oil G.P.H. Input	** I=B=R Burner Capacity Gas M.B.H. Input	*Net I=B=R Rating Water M.B.H.	*Net I=B=R Rating Steam M.B.H.	*Net I=B=R Rating Steam Sq. Ft.	Steam Piping Factor	***Vent Size	***Vent Height Feet (Min.)	Number of Sections
‡-704FDA SU or WU	446	13	3.95	571	388	335	1,396	1.333	9"	3	4
‡-705FDA SU or WU	576	17	5.10	735	501	432	1,800	1.333	9"	3	5
‡-706FDA SU or WU	707	21	6.20	899	615	530	2,208	1.333	9"	3	6
‡-707FDA SU or WU	837	25	7.40	1,064	728	628	2,617	1.333	10"	3	7
‡-708FDA SU or WU	967	29	8.50	1,228	841	725	3,021	1.333	10"	3	8
‡-709FDA SU or WU	1,098	33	9.60	1,392	955	824	3,433	1.333	10"	3	9
‡-710FDA SU or WU	1,228	37	10.80	1,556	1,068	921	3,838	1.333	10"	3	10
‡-711FDA SU or WU	1,358	41	12.00	1,720	1,181	1,026	4,275	1.333	12"	3	11
‡-712FDA SU or WU	1,488	45	13.00	1,884	1,294	1,135	4,729	1.311	12"	3	12
‡-713FDA SU or WU	1,619	48	14.20	2,048	1,408	1,243	5,179	1.302	12"	3	13
‡-714FDA SU or WU	1,749	52	15.40	2,212	1,521	1,352	5,633	1.294	12"	3	14
‡-715FDA SU or WU	1,879	56	16.40	2,376	1,634	1,458	6,075	1.289	14"	3	15
‡-716FDA SU or WU	2,010	60	17.60	2,541	1,748	1,561	6,504	1.288	14"	3	16
‡-717FDA SU or WU	2,140	64	18.80	2,705	1,861	1,661	6,921	1.288	14"	3	17
‡-718FDA SU or WU	2,270	68	19.80	2,869	1,974	1,762	7,342	1.288	14"	3	18
‡-719FDA SU or WU	2,401	72	21.00	3,033	2,088	1,864	7,767	1.288	14"	3	19
‡-720FDA SU or WU	2,531	76	22.00	3,197	2,201	1,965	8,188	1.288	14"	3	20
‡-721FDA SU or WU	2,661	80	23.50	3,361	2,314	2,066	8,608	1.288	14"	3	21
‡-722FDA SU or WU	2,791	83	24.50	3,525	2,427	2,167	9,029	1.288	16"	3	22
‡-723FDA SU or WU	2,922	87	25.50	3,689	2,541	2,269	9,454	1.288	16"	3	23
‡-724FDA SU or WU	3,052	91	26.50	3,854	2,654	2,370	9,875	1.288	16"	3	24

* The Net I=B=R Ratings shown include allowance for normal piping loss and pick-up load, in accordance with the Testing and Rating Standard for Low Pressure Cast Iron Heating Boilers of the Hydronics Institute. Water ratings are based on a piping and pick-up allowance factor of 1.15 steam ratings based on graduated factors in accordance with the Hydronics Institute Rating Standard.
The Peerless Heater Co. should be consulted before selecting a boiler for gravity hot water installations and installations having unusual piping and pick-up requirements such as extended piping systems, exposed piping, night set-back, night shut-down, etc

** I=B=R Burner Capacity is based on G.P.H. with a heating value of 140,000 BTU/gal Burner input based on maximum altitude of 2,000 ft —for other altitudes consult factory.

*** A 3 ft minimum height of vent above the roof is recommended. For any unusual venting conditions, consult your local building code or authority.

† Ratings based on 12½% CO_2, oil only



BOILER DIMENSIONS & TAPPING LOCATIONS

Boiler Burner Unit No.	Length Flush Jacket "A"	Length Combustion Chamber "B"	Flue Outlet "C"	Location "D" From Front "D"	Number of Supply Tappings	Number of Return Tappings	Location Intermediate Tapped Sections From Front	Center of Tappings				
								"E"	"E-1"	"E-2"	"E-3"	"E-4"
‡-704FDA SU or WU	25⅜"	19⅞"	9"	12½"	2-4"	1-3"	—	16⅞"	—	—	—	—
‡-705FDA SU or WU	30⅜"	24⅞"	9"	15"	2-4"	1-3"	—	21½"	—	—	—	—
‡-706FDA SU or WU	35½"	30"	9"	17½"	2-4"	1-3"	—	26⅝"	—	—	—	—
‡-707FDA SU or WU	40½"	35"	10"	20⅛"	2-4"	1-3"	—	31⅝"	—	—	—	—
‡-708FDA SU or WU	45⅝"	40⅛"	10"	22⅝"	2-4"	1-3"	—	36¾"	—	—	—	—
‡-709FDA SU or WU	50⅝"	45⅛"	10"	25⅛"	2-4"	1-3"	—	41¾"	—	—	—	—
‡-710FDA SU or WU	55¾"	50¼"	10"	27⅝"	2-4"	1-3"	—	46⅞"	—	—	—	—
‡-711FDA SU or WU	60¾"	55¼"	12"	30⅛"	2-4"	1-3"	—	51⅞"	—	—	—	—
‡-712FDA SU or WU	65⅞"	60⅜"	12"	32¼"	2-4"	1-3"	—	57"	—	—	—	—
‡-713FDA SU or WU	70⅞"	65⅜"	12"	35¼"	2-4"	1-3"	—	62"	—	—	—	—
‡-714FDA SU or WU	76"	70½"	12"	14¼"	2-4" & 1-3"	2-3"	8	67⅛"	36"	—	—	—
‡-715FDA SU or WU	81"	75½"	14"	14¼"	2-4" & 1-3"	2-3"	8	72¼"	36"	—	—	—
‡-716FDA SU or WU	86⅛"	80⅝"	14"	14¼"	2-4" & 2-3"	3-3"	8 & 11	77⅜"	36"	26"	—	—
‡-717FDA SU or WU	91⅛"	85⅝"	14"	14¼"	2-4" & 2-3"	3-3"	9 & 12	82½"	41"	26"	—	—
‡-718FDA SU or WU	96¼"	90¾"	14"	14¼"	2-4" & 2-3"	3-3"	6 & 13	87⅝"	26"	26"	—	—
‡-719FDA SU or WU	101¼"	95¾"	14"	14¼"	2-4" & 3-3"	4-3"	7, 10 & 13	92¾"	31"	31"	15"	—
‡-720FDA SU or WU	106⅜"	100⅞"	14"	14¼"	2-4" & 3-3"	4-3"	7, 11 & 14	97⅞"	31"	31"	20"	—
‡-721FDA SU or WU	111⅜"	105⅞"	14"	14¼"	2-4" & 3-3"	4-3"	6, 11 & 16	102½"	26"	26"	25⅜"	—
‡-722FDA SU or WU	116½"	111"	16"	15¼"	2-4" & 4-3"	5-3"	5, 9, 13 & 17	107⅝"	20⅞"	26"	20¼"	20¼"
‡-723FDA SU or WU	121½"	116⅛"	16"	15¼"	2-4" & 4-3"	5-3"	6, 10, 14 & 18	112⅝"	26"	26"	20¼"	20¼"
‡-724FDA SU or WU	126⅝"	121⅛"	16"	15¼"	2-4" & 4-3"	5-3"	6, 11, 15 & 19	117¾"	26"	26"	25⅜"	20¼"

The intermediate tapped sections have 3" supply and 3" return.

‡Apply Prefix "O" for oil — "G" or gas — "GO" for gas-oil.

THE MANUFACTURER RESERVES THE RIGHT TO MAKE CHANGES AT ANY TIME WITHOUT NOTICE.

SPECIFICATIONS FOR 7FDA BURNERS

OPERATING FEATURES Oil - Carlin Burner Gas, Gas/Oil - Peabody Gordon Piatt Burner	Oil			Gas			Gas/Oil		
	704 thru 705	706 thru 717	718 thru 724	704 thru 715	716	717 thru 724	704 thru 715	716	717 thru 724
On-Off Fixed Air	S	—	—	S	—	—	S	—	—
On-Off w/Lo Fire Start									
Controlled Air - Oil	—	S	S	—	—	—	S	S	S
Controlled Air - Gas	—	—	—	—	S	S	—	S	S
Combustion Safeguard									
Pre-purge	S	S	S	S	S	S	S	S	S
Pre-purge and Post-purge	O	O	O	O	O	O	O	O	O
Prewired Panel w/On-Off Switch (2 Lamps)	O	O	O	S	S	S	S	S	S
Air Flow Safety Switch	O	O	O	S	S	S	S	S	S
Manual Gas Shutoff Valve	—	—	—	S	S	S	S	S	S
Manual Gas Leakage Test Valve	—	—	—	S	S	S	S	S	S
Low Gas Pressure Switch	—	—	—	—	—	S	—	—	S
High Gas Pressure Switch	—	—	—	—	—	S	—	—	S
Automatic Gas Valve									
Diaphragm	—	—	—	S	—	—	S	—	—
Solenoid	—	—	—	S	S	S	S	S	S
Motorized	—	—	—	—	S	S	—	S	S
Automatic Pilot Solenoid	—	—	—	S	S	S	S	S	S
Main Gas Pressure Regulator	—	—	—	S	S	S	S	S	S
Pilot Gas Pressure Regulator	—	—	—	S	S	S	S	S	S
Two Stage Fuel Unit	S	S	S	—	—	—	S	S	S

S (standard) O (optional) — (does not apply)

STANDARD: 3450 RPM MOTORS					
OIL			GAS/GAS-OIL		
7FDA Unit Number	Voltage	Horsepower	7FDA Unit Number	Voltage	Horsepower
704FDA-705FDA	120-60/1	1/4	704FDA-706FDA	120-60/1	1/3
706FDA-710FDA	120-60/1	1/2	707FDA-712FDA	120-60/1	1/2
711FDA-717FDA	240-60/1	3/4	713FDA-715FDA	240-60/1	3/4
718FDA-721FDA	240-60/3	1	716FDA-721FDA	240-60/3	1 1/2
722FDA-724FDA	240-60/3	1 1/2	722FDA-723FDA	240-60/3	2
			724FDA	240-60/3	3

SUBMITTAL DATA

Peerless Boiler Burner Unit No. _____ **is submitted for the following job with ratings, dimensions, specifications and equipment as specified below:**

Water or Steam_____ Job _____

Gas and/or Oil Specs._____ Address _____

Output (BTU/Hr.)_____

Net Rating_____ Engineer _____

For other ratings, dimensions, and specifications see tables on pages 2,3,4 and 5

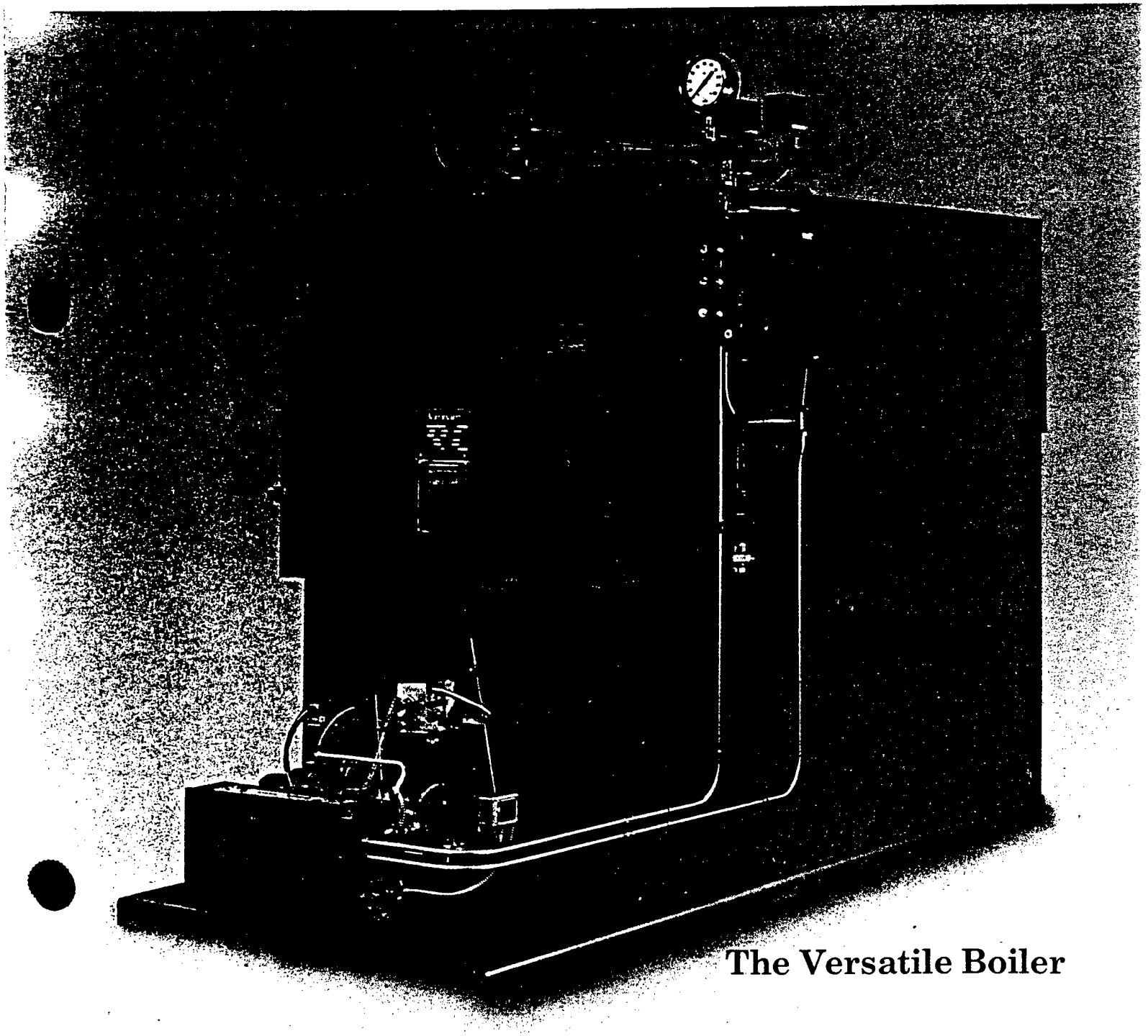
Boiler will include standard equipment as shown on pages 2,3,4 except: _____

Boiler will include the following specified options: _____

Exceptions to specifications: _____

Burnham

Series 4F-50 Forced Draft Firebox Generator



The Versatile Boiler

Burnham

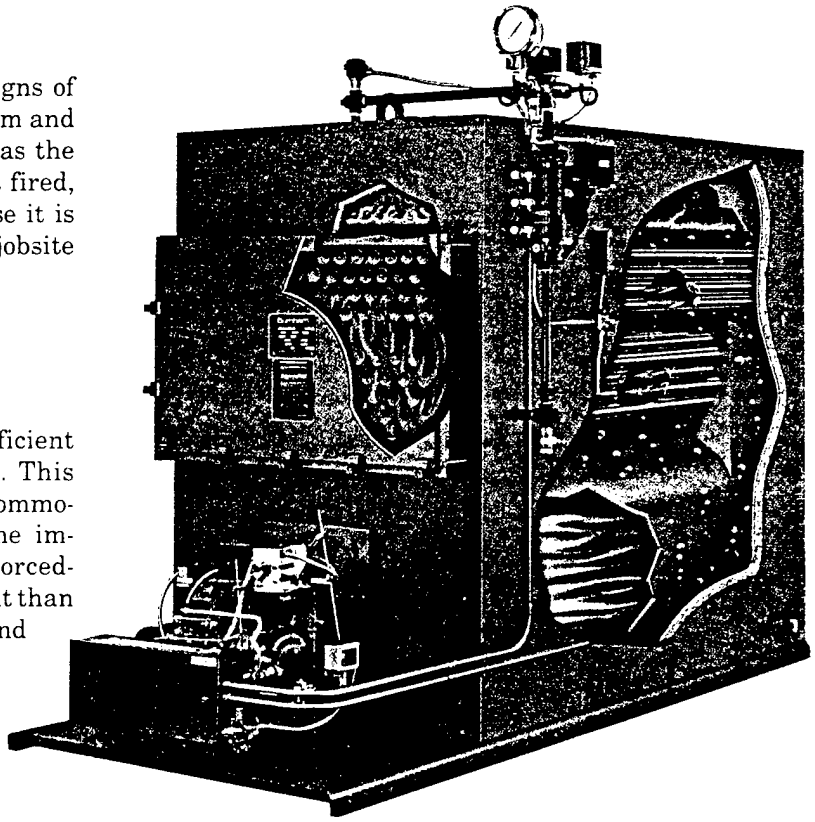
Series 4F-50 Forced Draft Firebox Generator

The Versatile Boiler

The Burnham 4F Forced Draft Steel Firebox Generator is a consistent sales leader in the heating industry, for reasons that make solid sense.

4F Saves on Installation

It is a compact boiler that fits where other designs of similar capacity cannot. Available for 15 psi steam and 30 or 60 psi water*, the 4F can serve perfectly as the heart of almost any system. As it is forced-draft fired, no tall, expensive stack is required. And because it is a factory-assembled, packaged unit, expensive jobsite time and labor are reduced.



4F Saves in Operation

The furnace surrounds the flame with highly-efficient waterbacked primary heat-absorbing surfaces. This large combustion chamber is easy to fire, accommodating many forced-draft burners without flame impingement or other critical firing problems. Forced-draft firing makes the 4F inherently more efficient than boilers using outmoded atmospheric burners, and gives you a feature that atmospheric units cannot offer: the option of burning gas or oil. A dual-fired burner allows you to burn the more economical fuel or the most readily available fuel at the flip of a switch, and affords you leverage in negotiating fuel prices.

The 4F is an economical heat source, whether used singly or in multiples. In fact, 4F's with modulating burners may be sequenced to operate in a step-fired system more cost effectively than a large number of residential-sized boilers when ongoing maintenance costs are considered.

4F Saves on Maintenance

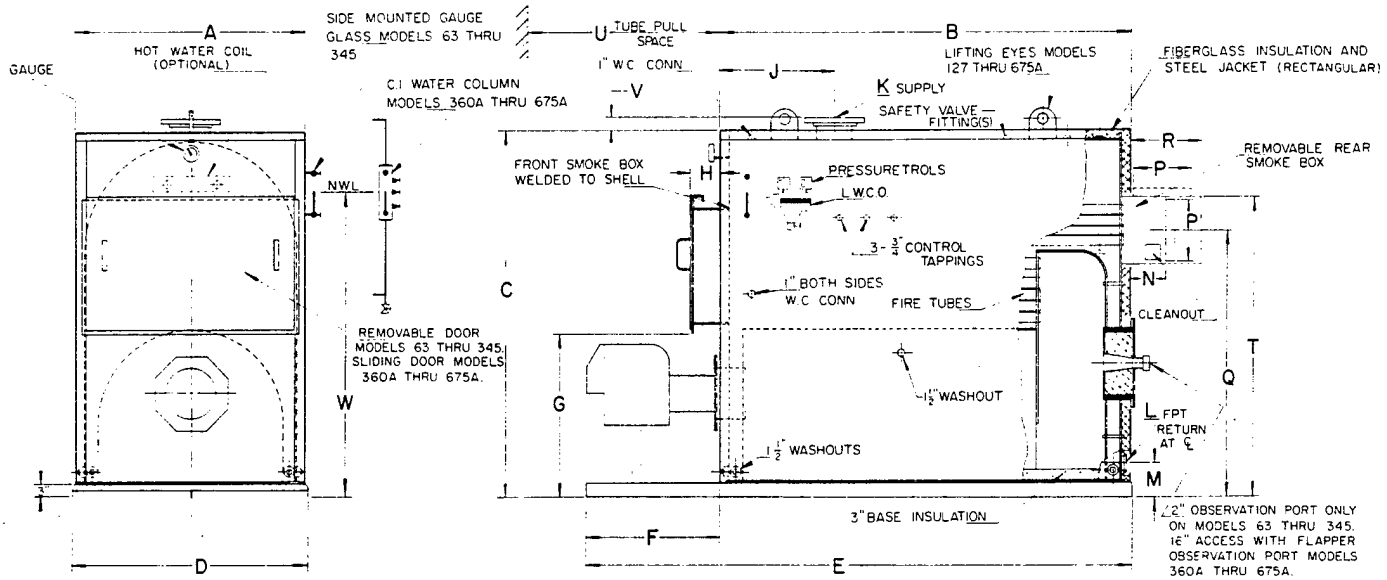
The 4F is easy to clean and maintain, requiring no special tools, materials, or skills. Opening the front flue door allows firetubes to be brushed out quickly unlike the watertubes used in some boilers, which can be virtually impossible to clean. There are no elaborate or expensive proprietary seals required to reclose the doors as with some boilers. And, as the 4F is a wetback boiler, there is no delicate or expensive rear refractory to maintain as with dryback boilers.

Since 1873, Burnham has been engineering and building quality products that have made their own reputation. You can be confident that your 4F will perform efficiently and dependably, year after year.

*60 psi water boiler available in sizes 4F-63 through 4F-675.

Series 4F-50

FORCED DRAFT PACKAGED BOILER



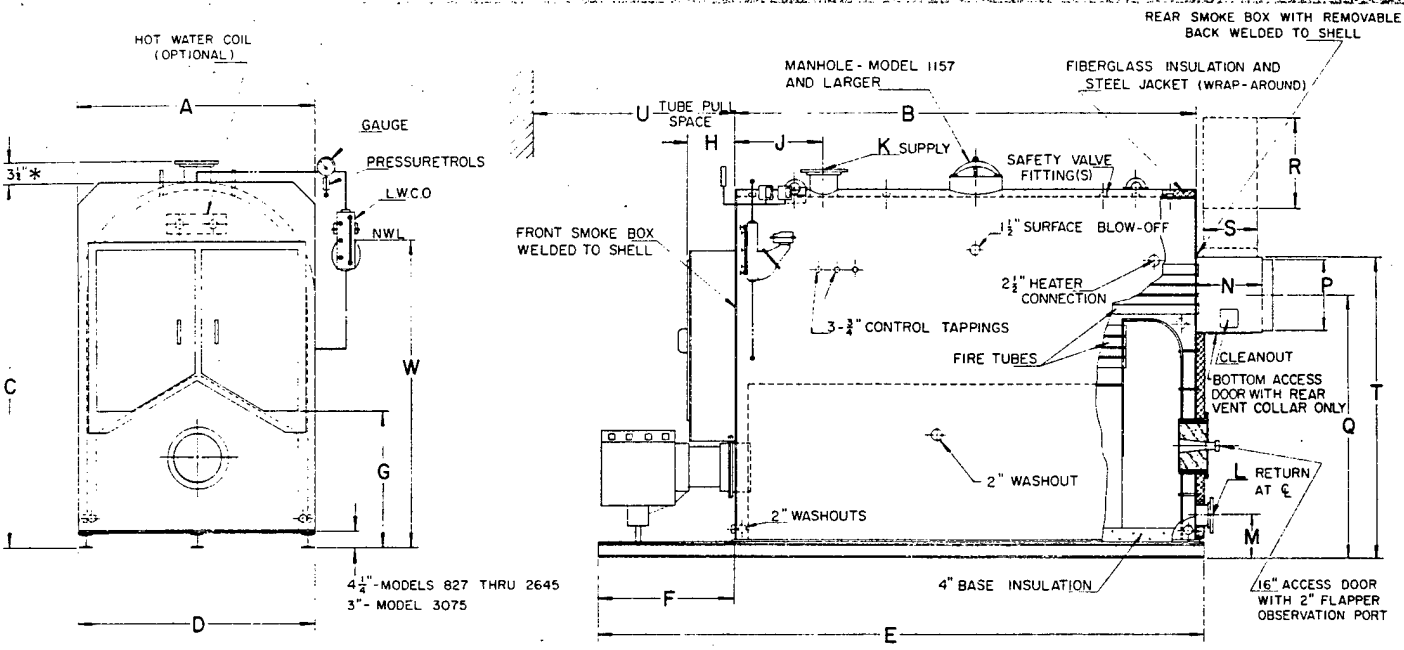
DIMENSIONS

4F Boiler Models													360A	450A	563A	675A
	63	78	92	107	127	154	180	209	240	277	311	345	360A-3	450A-3	563A-3	675A-3
A — Boiler Width	31	31	31	31	36 3/8	36 3/8	36 3/8	36 3/8	45 1/8	45 1/8	45 1/8	45 1/8	52 1/4	52 1/4	56 1/8	56 1/8
B — Boiler Length	32	39	45 1/2	52 1/2	44 1/2	53	61	70	57	65	72 1/2	80	80 3/4	93 1/4	104 3/8	122 1/4
C — Boiler Height	55 1/4	55 1/4	55 1/4	55 1/4	63 5/8	63 5/8	63 5/8	63 5/8	70 5/8	70 5/8	70 5/8	70 5/8	82 3/8	82 3/8	85 1/8	85 1/8
D — Base Width	33 1/4	33 1/4	33 1/4	33 1/4	38 5/8	38 5/8	38 5/8	38 5/8	47 3/8	47 3/8	47 3/8	47 3/8	53 1/8	53 1/8	57	57
E — Base Length	47 1/2	54 1/2	65	72	64	72 1/2	80 1/2	92 1/2	79 1/2	87 1/2	95	102 1/2	107 1/2	124	135 1/8	153
F — Base Extension	15 1/2	15 1/2	19 1/2	19 1/2	19 1/2	19 1/2	19 1/2	22 1/2	22 1/2	22 1/2	22 1/2	22 1/2	26 3/4	30 3/4	30 3/4	30 3/4
G — Front Smoke Box Height	26	26	26	26	27 7/8	27 7/8	27 7/8	27 7/8	33 1/2	33 1/2	33 1/2	33 1/2	36 3/4	36 3/4	39 1/2	39 1/2
H — Front Smoke Box Depth	5 1/2	5 1/2	5 1/2	5 1/2	6 1/2	6 1/2	6 1/2	6 1/2	7 1/2	7 1/2	7 1/2	7 1/2	6 1/2	6 1/2	7 1/2	7 1/2
J — Supply Location	13	13	13	13	16	16	16	16	19	19	19	19	26	26	26	26
*K — Supply Size	4	4	4	4	4	4	4	4	6	6	6	6	8	8	8	8
*L — Return Size	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4
M — Return Location	6 1/2	6 1/2	6 1/2	6 1/2	7	7	7	7	7	7	7	7	7 1/4	7 1/4	7 3/8	7 3/8
N — Smoke Box Depth—Rear Vent	6	6	6	6	7	7	7	7	8	8	8	8	8	8	8	8
P — Vent Collar Diameter	7	7	7	7	10	10	10	10	12	12	12	12	14	14	18	18
Q — Rear Vent Collar Height	38	38	38	38	45 3/4	45 3/4	45 3/4	45 3/4	51 1/4	51 1/4	51 1/4	51 1/4	58 3/4	58 3/4	59 5/8	59 5/8
R — Smoke Box Depth—Top Vent	9	9	9	9	12	12	12	12	14	14	14	14	16	16	19 1/2	19 1/2
T — Top Vent Collar Height	42 1/2	42 1/2	42 1/2	42 1/2	51 3/4	51 3/4	51 3/4	51 3/4	58 1/2	58 1/2	58 1/2	58 1/2	66 1/4	66 1/4	69 1/8	69 1/8
U — Tube Pull Space	32	39	45 1/2	52 1/2	44 1/2	53	61	70	57	65	72 1/2	80	81	94	105	123
V — Supply Fitting Height	2	2	2	2	2	2	2	2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2
W — Normal Water Line Height	43 3/4	43 3/4	43 3/4	43 3/4	51 1/2	51 1/2	51 1/2	51 1/2	58	58	58	58	69 1/4	69 1/4	72	72

*3" and 4" are IPS female thread. 6" and larger are flanged.

Specifications, Dimensions Data Subject to Change without Notice

Burnham
AMERICA'S BOILER COMPANY



ot 3075 has saddle flange outlet flush with top of jacket

DIMENSIONS

4F Boiler Models	827	993	1157	1323	1654	1985	2315	2645	3075
A — Boiler Width	64	64	70	70	76	82	82	82	96
B — Boiler Length	106¼	129	116½	136	130½	128	148	163	163
C — Boiler Height	95¼	95¼	106¾	106¾	122⅜	142⅜	142⅜	142⅜	151
D — Base Width	64	64	70	70	76	82	82	82	96
E — Base Length	138¼	161	158½	178	172½	170	190	205	213
F — Base Extension	30	30	40	40	40	40	40	40	48
G — Front Smoke Box Door-Height	33⅜	33⅜	38¾	38¾	44⅝	54⅜	54⅜	54⅜	68⅝
H — Front Smoke Box Depth	12¾	12¾	13¾	13¾	14¾	15¾	15¾	15¾	16½
J — Supply Location	22	22	22	22	22	22	22	22	68
*K — Supply Size	8	8	8	8	10	12	12	12	12
*L — Return Size—Steam Boiler	4	4	4	6	6	6	6	6	6
Return Size—Water Boiler	6	6	6	8	8	8	8	8	8
M — Return Location	10¼	10¼	11⅛	11⅛	11⅛	11⅛	11⅛	11⅛	10
N — Rear Smoke Box Depth	19⅜	19⅜	19⅜	19⅜	21⅜	23⅜	23⅜	23⅜	23⅜
P — Rear Vent Collar Diameter	20	20	22	22	24	28	28	28	32
Q — Rear Vent Collar Height	66¼	66¼	76¾	76¾	90¾	106¼	106¼	106¼	112
R — Top Vent Collar Width	22	22	26	26	28	34	34	34	44
S — Top Vent Collar Depth	16	16	16	16	18	20	20	20	20
T — Top Vent Collar Height	76¼	76¼	87⅞	87⅞	102¾	120½	120½	120½	129
U — Tube Pull Space	108	131	118½	138	132½	130	150	165	165
W — Normal Water Line Height	78¼	78¼	89¾	89¾	104½	118½	118½	118½	125½

*4" is IPS female thread, 6" and larger are flanged

Specifications, Dimensions Data Subject to Change without Notice

- *Compact, efficient three-pass firebox design.*
- *No tall or costly stack required.*
- *Forced-draft firing with oil (No. 2, 4, 5, or 6), gas, or combination gas/oil.*
- *15 PSI steam, 30 or 60 PSI water.*
- *Ample firebox assures non-critical combustion, high efficiency.*

Ratings and Data Boiler Model 4F-50		63	78	92	107	127	154	180	209	240	277	311	345	360A	450A	563A	675A
Gross Output	MBH	442	522	616	716	850	1031	1205	1400	1607	1855	2082	2310	2410	3015	3770	4520
	BHP	12.6	15.6	18.4	21.4	25.4	30.8	36.0	41.8	48.0	55.4	62.2	69.0	72.0	90.0	112.6	135.0
	Lb. Stm/Hr.	455	538	635	738	876	1063	1242	1442	1656	1911	2146	2381	2484	3108	3885	4660
Net Rating Steam	MBH	327	405	478	556	660	800	935	1086	1247	1439	1616	1793	1870	2340	2926	3508
	Sq. Ft.	1365	1690	1990	2315	2750	3335	3895	4525	5195	5995	6735	7470	7790	9750	12190	14615
Net Rating Water	MBH	367	454	536	623	740	897	1048	1218	1398	1614	1811	2010	2097	2623	3280	3932
Firing Rate—Gas	MBH	528	653	770	895	1063	1289	1506	1750	2009	2319	2603	2888	3013	3769	4713	5650
Firing Rate—Oil	GPH:																
Light Oil (140,000 BTU/Gal.)		3.8	4.7	5.5	6.4	7.6	9.2	10.8	12.5	14.4	16.6	18.6	20.6	21.5	27.0	33.6	40.4
Heavy Oil (150,000 BTU/Gal.)		—	—	—	—	—	—	—	—	—	—	—	—	20.1	25.2	31.4	37.7
Heating Surface Sq. Ft:																	
Fireside		59	73	86	101	120	145	168	194	224	257	289	320	360	450	563	675
Waterside		63	78	92	107	127	154	180	209	240	277	311	345	398	497	622	746
Furnace Volume Cu. Ft.		8.8	10.7	12.6	14.6	18.3	21.9	25.3	29.1	34.7	39.7	44.4	49.1	58.9	68.0	89.3	104.7
Heat Release MBH/Cu. Ft.		60.0	61.0	61.1	61.3	58.1	58.8	59.5	60.1	57.9	58.4	58.6	58.8	51.2	55.4	52.8	53.9
Water Content Gal:																	
Steam		65	81	94	110	133	145	172	198	214	245	274	302	470	537	683	788
Water		90	112	132	153	168	196	232	268	288	329	369	408	569	666	801	951
Approx. Dry Weight Lbs.		1700	1900	2100	2600	2700	3100	3300	3600	4200	4400	5300	5600	6700	8700	9300	10400
Approx. Weight Full Lbs.																	
Steam		2240	2570	3090	3510	3800	4300	4730	5250	5980	6435	7575	8110	10615	13290	14825	16970
Water		2450	2835	3195	3870	4095	4735	5235	5830	6595	7140	8365	8995	11495	14255	15975	18325

Ratings and Data Boiler Model 4F-50		360A-3	450A-3	563A-3	675A-3	827	993	1157	1323	1654	1985	2315	2645	3075
Gross Output	MBH	2658	3100	3769	4432	5537	6648	7746	8857	11074	13290	15499	17708	20587
	BHP	79.4	92.6	112.6	132.4	165.0	199.0	231.0	265.0	331.0	397.0	463.0	529.0	615.0
	Lb. Stm/Hr.	2739	3195	3885	4568	5706	6852	7983	9129	11413	13697	15974	18252	21217
Net Rating Steam	MBH	2063	2406	2925	3439	4299	5161	6014	6877	8598	10318	12033	13748	15976
	Sq. Ft.	8596	10025	12188	14329	17910	21505	25060	28655	35825	42995	50140	57285	66525
Net Rating Water	MBH	2312	2697	3279	3856	4817	5784	6739	7706	9634	11562	13484	15406	17911
Firing Rate—Gas	MBH	3323	3875	4711	5540	6921	8310	9683	11071	13843	16613	19374	22135	25734
Firing Rate—Oil	GPH:													
Light Oil (140,000 BTU/Gal.)		23.7	27.7	33.7	39.6	49.9	60.0	70.0	80.0	99.0	119.0	139.0	158.0	184.0
Heavy Oil (150,000 BTU/Gal.)		22.2	25.8	31.4	36.9	46.6	56.0	65.3	74.7	92.4	110.7	129.3	148.0	172.0
Heating Surface	Sq. Ft.:													
Fireside		397	463	563	662	827	993	1157	1323	1654	1985	2315	2645	3075
Waterside		429	500	608	715	893	1072	1250	1429	1786	2143	2500	2857	3321
Furnace Volume	Cu. Ft.	58.9	68.0	89.3	104.7	115.6	139.2	160.7	186.5	234.0	301.6	348.6	383.8	505.6
Heat Release	MBH/Cu. Ft.	56.4	57.0	52.8	52.9	59.9	59.7	60.3	59.4	59.2	55.1	55.6	63.5	50.9
Water Content	Gals:													
Steam		421	492	602	712	761	925	1050	1227	1443	1720	1979	2173	2814
Water		519	676	740	875	1003	1220	1330	1554	1826	2147	2473	2718	3665
Approx. Dry Weight Lbs.		6900	8800	11000	12400	14800	18300	19200	19800	23000	28000	34500	38200	49000
Approx. Weight Full Lbs:														
Steam		10405	12900	14315	16930	18970	22500	27040	29415	35010	42320	50970	56290	72430
Water		11225	14430	15465	18290	20325	24950	29375	32140	38200	45870	55085	60820	79510

Ratings based on 5 square feet of heating surface per boiler horsepower.

Series 4F-50 Forced Draft Firebox Generator

STANDARD EQUIPMENT

BOILER:

Three-pass boiler constructed and stamped in accordance with Section IV of the ASME Code for 15 psi steam or 30 psi water, sealed for forced draft firing with skid base and floor insulation, top smoke outlet 63-345, rear outlet 360 and larger (optional outlet available), gas tight front flue cleanout door, rear observation port 63 through 345, rear access door with observation port 360 and larger, lifting lugs 127 and larger, flue brush and handle.

JACKET:

Rectangular type with fiber glass insulation 63 through 675, wrap-around type with fiber glass insulation 827 and larger; factory installed.

STEAM TRIM:

Steam pressure gauge (3½ inch 63 through 675; 6 inch 827 and larger), gauge glass set for mounting on boiler with 63 through 345, cast iron water column with gauge glass set and tricocks 360 and larger, ASME safety valve(s). Trim shipped not installed.

WATER TRIM:

Theraltimeter (3½ inch) 63 through 675, pressure/altitude gauge (6 inch) and thermometer (5 inch) 827 and larger, ASME relief valve(s); not installed.

CONTROLS:

High limit control, operating control, firing rate controller (with hi-lo or modulating sequence); installed and wired.

Low Water Cut Off: #767 with 63 through 675 steam unit, #157 pump control/low water cut-off with 827 and larger steam unit, #764 with 63 through 675 water unit, #63B with 827 and larger water unit; installed and wired.

BURNER:

As selected for the fuel to be burned, mounted and wired. Refer to burner data sheets for detail of burner equipment. Burners available for gas, No. 2 oil, No. 4 oil, No. 5 oil, No. 6 oil, combination gas/No. 2 oil, gas/No. 4 oil, gas/No. 5 oil, gas/No. 6 oil.

INSTANTANEOUS HOT WATER HEATING COILS

		Rated Capacity—Gallons Heated 40° to 140° F. Boiler Water Temp.		
Coil Number	*For Use in the Following Boiler Sizes Subject to Capacity Limitation of Boiler	180° F. GPM	180° F. GPH	212° F. GPH
INA-210	All sizes	3.5	210	325
INA-300	All sizes except 4F-63	5.0	300	466
INA-360	All sizes	6.0	360	560
INA-450	All sizes except 4F-63	7.5	450	700
INA-600	4F-154 and larger, also 4F-107	10.0	600	933
INA-750	4F-154 and larger, also 4F-107	12.5	750	1165
INA-900	4F-92 and larger	15.0	900	1400
INA-1125	4F-154 and larger	18.7	1125	1750
INA-1350	4F-277 and larger, also 4F-209	22.5	1350	2100
INA-1500	4F-345 and larger	25.0	1500	2330

*Two coils of any size or combination may be installed in 4F-1157 and larger.

Burnham
HYDRONICS DIVISION
Lancaster, PA 17604
(717) 397-4700

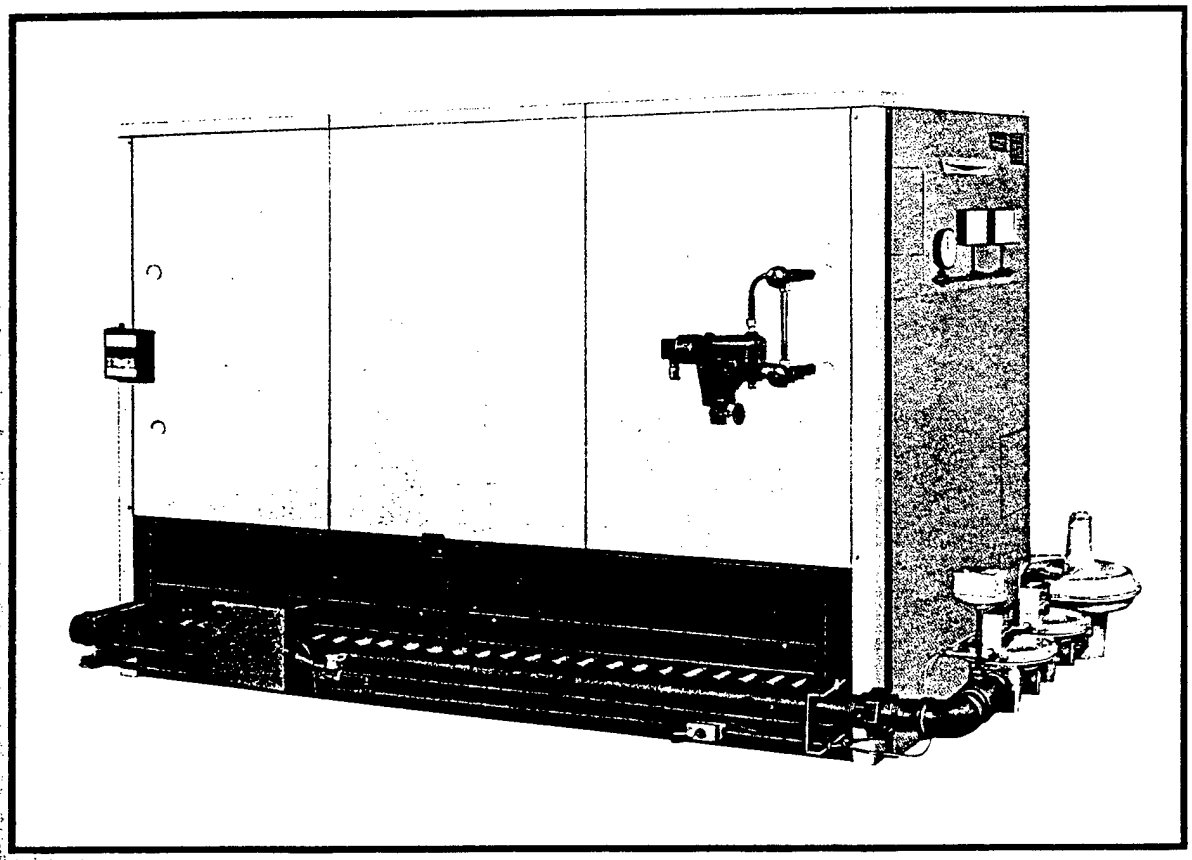
Form No. 3525A-586-5Ma

PEERLESS

OF BOYERTOWN, PENNSYLVANIA
SINCE 1908

SERIES
211A

GAS-FIRED
INDUSTRIAL/COMMERCIAL
CAST IRON BOILER



MEMBER
HYDRONICS INSTITUTE

43 SIZES

FOR HOT WATER OR STEAM

FOR USE WITH NATURAL & PROPANE GASES

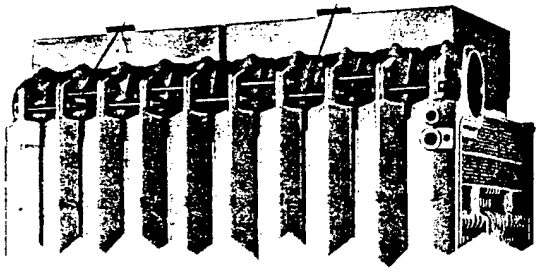
•

630,000 to 9,450,000 BTU/hr. Input

Castings-Certified by Eastern Foundry Company, Boyertown, PA 19512

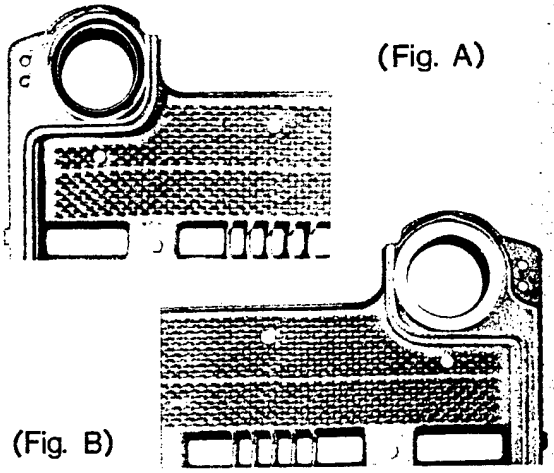
Division of Peerless Industries, Inc.

FEATURES



ALUMINIZED STEEL FLUE COLLECTOR

The Peerless boiler is equipped with Aluminized Steel Flue Collectors and Horizontal-to-Vertical Draft Diverters for extra long life. This assembly maintains a predetermined height of the flue outlet regardless of boiler size. High chimneys and forced (or induced) draft are not required for efficient operation.

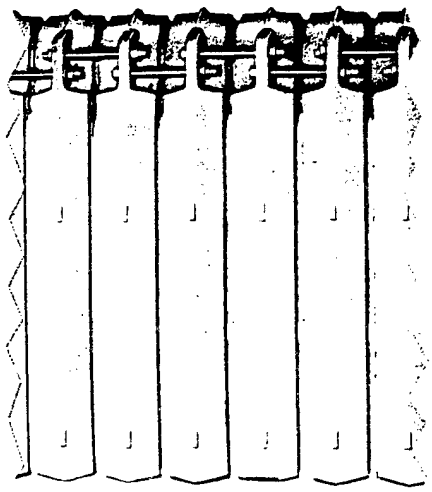


(Fig. A)

(Fig. B)

FLOW PORT GASKET SEALING

The Peerless Series 211A boiler features a unique method for sealing sections. Each section's flow port has a machined recess (fig. A) which holds the flow port gasket. The opposite side has a flat machined surface (fig. B) which compresses the gasket when sections are drawn together with the individual short draw-rods. This assures a water-tight seal and permits faster boiler assembly.



PRECISION GROUND SPACING RINGS

All Peerless water tube sections are evenly spaced using spacing rings ... to avoid long iron-to-iron contact. This allows the sections to retain their natural (as cast) skin and provides maximum corrosion resistance and longer life for Peerless boilers. Sections are designed to be pulled together, section-by-section (using individual draw-rods), as the boiler is assembled. Spaces between sections are sealed with a compressible, heat resistant rope ... forming a permanent, gas tight joint and to allow for expansion and contraction of boiler.

DISTRIBUTED BY:

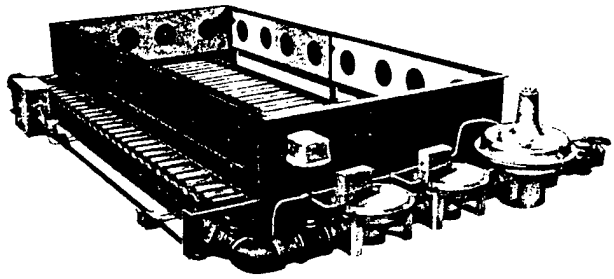
Printed in U.S.A. 15-888S

SERIES 211A

INSULATED BASE

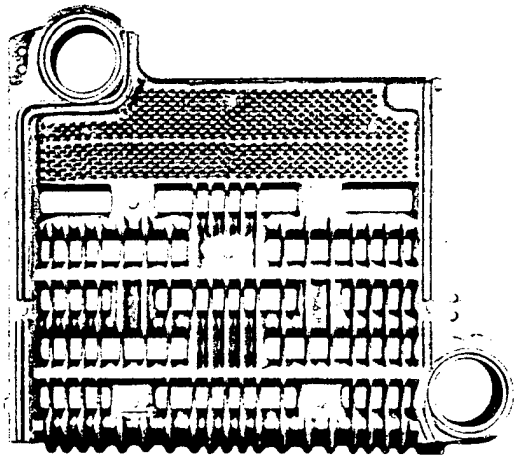
Peerless quality includes pre-assembled gas train, pre-assembled manifold with orifice adapters. Insulated steel base insures correctness of fit and simplifies field assembly. The total assembly is shipped in sections most convenient for crating and shipping. All crates are coded, as per contents enclosed.

Photo illustrates complete base, burners, and gas train assembled.



FAMOUS CAST IRON MULTIPLE FINNED WATER TUBE SECTIONS

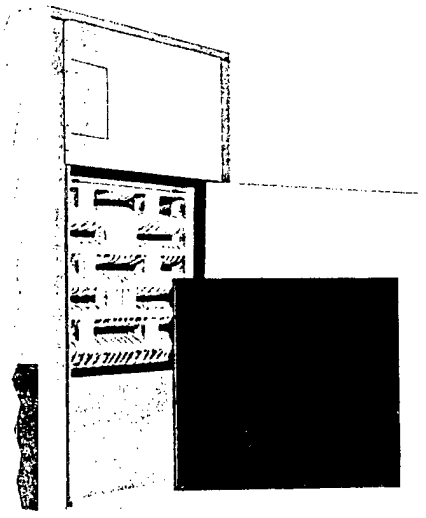
Peerless boiler sections are designed in a unique pattern to provide super strength and long life without unnecessary weight. The sections — vertical risers joining horizontal off-center tubular water passages — form "closed H" type, sturdy supporting units. When assembled, these sections form 13 staggered flue passages per boiler section. They force the hot gases to twist and turn through, and around each multiple finned water tube for maximum contact with heat absorbing surfaces.



ACCESS DOORS AT BOTH ENDS OF BOILER

Inspection and cleaning of the flueways in a Peerless Series 211A boiler are more convenient since they can be accomplished from either end. Two (2) jacket sections (one at each end of the boiler) may be taken out without removing the jacket. This permits easy removal of jacket panels and provides access to the insulated, heavy steel doors mounted directly to the end sections.

This exclusive feature makes the Peerless Series 211A boiler an ideal choice for Sewage or Industrial Plants using heavy deposit, self-manufactured gases since it provides easier access for the more frequent cleanings of flueways so necessary to maintain high boiler efficiency.



PEERLESS

OF BOYERTOWN, PENNSYLVANIA
SINCE 1908

SERIES 211A
GAS FIRED
INDUSTRIAL/COMMERCIAL
CAST IRON BOILER

Certified by Eastern Foundry Company, A Division of Peerless Industries, Inc., Boyertown, PA 19512

ORDERING INFORMATION

SPECIFY:

- Water — Steam Example: 211A-10S or 211A-10W.
- For 80 Lb. W.P. boilers, specify "WT" Example: 211A-10WT.
- Natural Gas: Specify B.T.U., specific gravity of gas and supply gas pressure.
  Example: 1020 B.T.U. .60 S.G. 10" WC
- Propane Gas: Specify B.T.U. and specific gravity of gas
  Example: 2500 B.T.U. 1.50 S.G. 14" W.C.
- Flush Jacket

NATURAL GAS									PROPANE GAS 2500 B.T.U.									
				*NET 1=B=R RATING							*NET 1=B=R RATING							
Boiler Number "S" or "W"	A.G.A. Input M.B.H.	A.G.A. Output M.B.H.	Boiler H.P.	Steam Sq. Ft.	Steam M.B.H.	Water M.B.H.	Gas Connection Size (inches)	Steam Piping Factor	A.G.A. Input M.B.H.	A.G.A. Output M.B.H.	Steam Sq. Ft.	Steam M.B.H.	Water M.B.H.	Gas Connection Size (inches)	Steam Piping Factor	Draft Hoods Number & Size	Flue Size to Stack	Chimney Size
211A-04	630	497.7	14.8	1,554	373	433	1"	1.333	615	492	1,538	369	428	1	1.333	(1) 12"	12"	12"x20'
211A-05	840	663.6	19.8	2,075	498	577	1	1.333	820	656	2,050	492	570	1	1.333	(1) 12"	12"	12"x20'
211A-06	1,050	840.0	25.1	2,625	630	730	1¼	1.333	1,025	820	2,563	615	713	1¼	1.333	(1) 14"	14"	14"x20'
211A-07	1,260	995.4	29.7	3,113	747	866	1¼	1.333	1,230	984	3,075	738	856	1¼	1.333	(2) 12"	14"	14"x20'
211A-08	1,470	1,161.3	34.6	3,629	871	1,010	1¼	1.333	1,435	1,148	3,588	861	998	1¼	1.333	(2) 12"	15"	15"x20'
211A-09	1,680	1,327.2	39.6	4,171	1,001	1,154	1½	1.326	1,640	1,312	4,121	989	1,141	1½	1.327	(2) 12"	16"	16"x20'
211A-10	1,890	1,493.1	44.5	4,746	1,139	1,298	1½	1.311	1,845	1,476	4,688	1,125	1,283	1½	1.312	(2) 14"	17"	17"x20'
211A-11	2,100	1,680.0	50.1	5,392	1,294	1,461	2	1.298	2,050	1,640	5,258	1,262	1,426	2	1.300	(2) 14"	18"	18"x20'
211A-12	2,310	1,824.9	54.4	5,896	1,415	1,587	2	1.290	2,255	1,804	5,821	1,397	1,569	2	1.291	(3) 12"	18"	18"x20'
211A-13	2,520	1,990.8	59.4	6,442	1,546	1,731	2	1.288	2,460	1,968	6,367	1,528	1,711	2	1.288	(3) 12"	19"	19"x20'
211A-14	2,730	2,156.7	64.3	6,975	1,674	1,875	2	1.288	2,665	2,132	6,896	1,655	1,854	2	1.288	(3) 14"	20"	20"x20'
211A-15	2,940	2,322.6	69.3	7,513	1,803	2,020	2	1.288	2,870	2,296	7,429	1,783	1,997	2	1.288	(3) 14"	21"	21"x20'
211A-16	3,150	2,520.0	75.2	8,154	1,957	2,191	2	1.288	3,075	2,460	7,958	1,910	2,139	2	1.288	(3) 14"	21"	21"x20'
211A-17	3,360	2,654.4	79.2	8,588	2,061	2,308	2	1.288	3,280	2,624	8,488	2,037	2,282	2	1.288	(4) 14"	22"	22"x20'
211A-18	3,570	2,820.3	84.1	9,125	2,190	2,452	2½	1.288	3,485	2,788	9,021	2,165	2,424	2½	1.288	(4) 14"	23"	23"x20'
211A-19	3,780	2,986.2	89.1	9,658	2,318	2,597	(2) 2	1.288	3,690	2,952	9,550	2,292	2,567	2½	1.288	(4) 14"	23"	23"x20'
211A-20	3,990	3,152.1	94.0	10,196	2,447	2,741	(2) 2	1.288	3,895	3,116	10,079	2,419	2,710	(2) 2	1.288	(4) 14"	24"	24"x20'
211A-21	4,200	3,360.0	100.2	10,871	2,609	2,922	(2) 2	1.288	4,100	3,280	10,613	2,547	2,852	(2) 2	1.288	(4) 14"	25"	25"x20'
211A-22	4,410	3,483.9	103.9	11,271	2,705	3,029	(2) 2	1.288	4,305	3,444	11,142	2,674	2,995	(2) 2	1.288	(5) 14"	25"	25"x20'
211A-23	4,620	3,649.8	108.9	11,808	2,834	3,174	(2) 2	1.288	4,510	3,608	11,671	2,801	3,137	(2) 2	1.288	(5) 14"	26"	26"x20'
211A-24	4,830	3,815.7	113.8	12,346	2,963	3,318	(2) 2	1.288	4,715	3,772	12,204	2,929	3,280	(2) 2	1.288	(5) 14"	26"	26"x20'
211A-25	5,040	3,981.6	118.8	12,879	3,091	3,462	(2) 2	1.288	4,920	3,936	12,733	3,056	3,423	(2) 2	1.288	(5) 14"	27"	27"x20'
211A-26	5,250	4,200.0	125.3	13,588	3,261	3,652	(2) 2	1.288	5,125	4,100	13,263	3,183	3,565	(2) 2	1.288	(5) 14"	27"	27"x20'
211A-27	5,460	4,313.4	128.7	13,954	3,349	3,751	(2) 2	1.288	5,330	4,264	13,796	3,311	3,708	(2) 2	1.288	(6) 14"	28"	28"x20'
211A-28	5,670	4,479.3	133.6	14,492	3,478	3,895	(2) 2	1.288	5,535	4,428	14,325	3,438	3,850	(2) 2	1.288	(6) 14"	29"	29"x20'
211A-29	5,880	4,645.2	138.6	15,029	3,607	4,039	(2) 2	1.288	5,740	4,592	14,854	3,565	3,993	(2) 2	1.288	(6) 14"	29"	29"x20'
211A-30	6,090	4,811.1	143.5	15,563	3,735	4,184	(2) 2	1.288	5,945	4,756	15,388	3,693	4,136	(2) 2	1.288	(6) 14"	30"	30"x20'
211A-31	6,300	5,040.0	150.4	16,304	3,913	4,383	(2) 2	1.288	6,150	4,920	15,917	3,820	4,278	(2) 2	1.288	(6) 14"	30"	30"x20'
211A-32	6,510	5,142.9	153.4	16,638	3,993	4,472	(2) 2	1.288	6,355	5,084	16,446	3,947	4,421	(2) 2	1.288	(7) 14"	31"	31"x20'
211A-33	6,720	5,308.8	158.4	17,175	4,122	4,616	(2) 2	1.288	6,560	5,248	16,979	4,075	4,563	(2) 2	1.288	(7) 14"	31"	31"x20'
211A-34	6,930	5,474.7	163.3	17,713	4,251	4,761	(2) 2½	1.288	6,765	5,412	17,508	4,202	4,706	(2) 2½	1.288	(7) 14"	32"	32"x20'
211A-35	7,140	5,640.6	168.3	18,246	4,379	4,905	(2) 2½	1.288	6,970	5,576	18,038	4,329	4,849	(2) 2½	1.288	(7) 14"	32"	32"x20'
211A-36	7,350	5,880.0	175.4	19,021	4,565	5,113	(2) 2	1.288	7,175	5,740	18,571	4,457	4,991	(2) 2½	1.288	(7) 14"	33"	33"x20'
211A-37	7,560	5,972.4	178.2	19,321	4,637	5,193	(2) 2	1.288	7,380	5,904	19,100	4,584	5,134	(2) 2½	1.288	(8) 14"	33"	33"x20'

Models 211A-38 thru 211A-46 (for Natural Gas only) are available on special request. Contact the factory.

* **The Net I=B=R Ratings shown include allowance for normal piping and pickup load in accordance with Testing and Rating standard for Low Pressure Cast Iron Heating Boilers of the Hydronics Institute. Water ratings are based on piping and pickup allowance factor of 1.15. Steam ratings based on graduated factors in accordance with The Hydronics Institute standard. The Peerless Heater Company should be consulted before selecting a boiler for gravity hot water installations and installations having unusual piping and pickup requirements, such as exposed piping, night shutdown, etc.**

Ratings shown are for elevations up to 2,000 feet. For elevations above 2,000 feet ratings should be reduced at the rate of 4 percent for each 1,000 feet above sea level.

All A.G.A. certified equipment for:

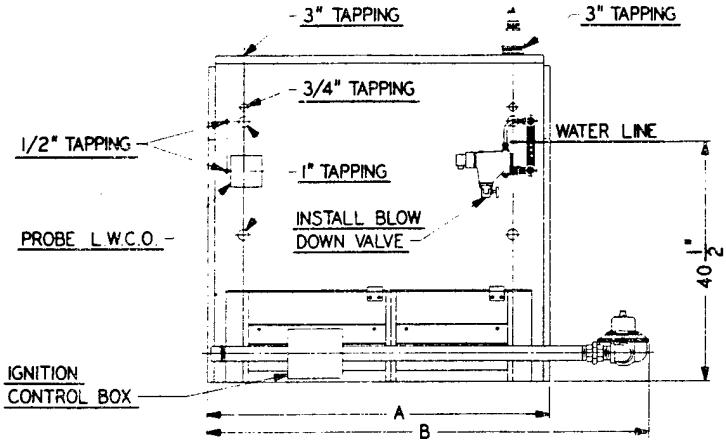
1. Natural Gas require an inlet gas pressure at the manual valve of 5 in. W.C. minimum to 14 in. W.C. maximum. Where inlet pressure exceeds 14 in. W.C., a service gas pressure regulator of the lock-up type must be installed in the gas supply piping to the boiler.
2. Propane gas requires an inlet gas pressure at the manual valve of 12.5 in W.C. minimum to 14 in. W.C. maximum. Where inlet pressure exceeds 14 in. W.C. a service gas pressure regulator of the lock-up type must be installed in the gas supply piping to the boiler.

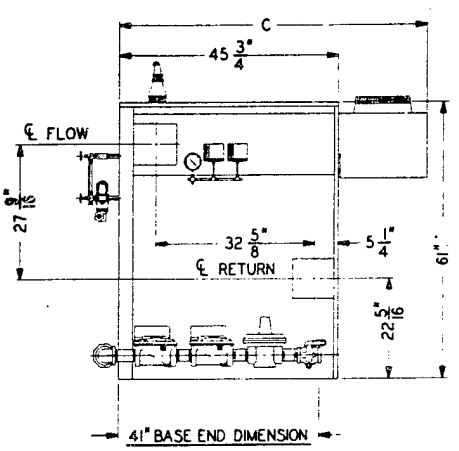
The "Flue Size to Stack" and "Chimney Size" for each boiler model may be decreased two (2) inches in diameter if the chimney height is increased to 30 feet.

Minimum chimney height of 20 feet is based on using 6 feet of lateral connector at flue size shown from the nearest draft divertor outlet with no more than one standard 90 deg. elbow. If individual vertical vent(s) are used for the same size as the draft divertor outlet(s), the height may be reduced to 5 feet measured above draft divertor outlet(s).

"Total Chimney Height" is the measured vertical distance between the draft hood outlet and the chimney top.

A vertical riser height of 3 to 5 feet from the draft hoods to the breeching is required to maintain satisfactory draft conditions.





FRONT VIEW — SINGLE CONTROLS

Controls: End Mounted Standard.

END VIEW — FLUSH JACKET

Controls: End Mounted Standard.

Boiler Model Number	Dimensions Length and Width			Center Line Dimensions-3" Tapping Supply & Return Intermediate Tapped Sections (Steam Only)									Center Line Dimensions Draft Divertors				
	A	B	C	D	E	F	G	H	I	J	K	L	AA	BB	CC	DD	EE
211A-04	28⅛"	38⅜"	63"	BOILER MODEL NUMBERS 211A-04S TO 211A-17S INCLUSIVE DO NOT INCORPORATE INTERMEDIATE TAPPED SECTIONS									10⅞"				
211A-05	33¾"	44"	63"										13¾"				
211A-06	39⅜"	50¼"	65"										16½"				
211A-07	45"	55⅞"	63"										10⅞"	16⅞"			
211A-08	50⅝"	61¾"	63"										13¾"	19⅝"			
211A-09	56¼"	67⅝"	63"										13¾"	22½"			
211A-10	61⅞"	73¼"	65"										16½"	25⅜"			
211A-11	67½"	80¾"	65"										16½"	28⅛"			
211A-12	73⅛"	86⅜"	63"										13¾"	22½"	19⅝"		
211A-13	78¾"	91½"	63"										13¾"	22½"	22½"		
211A-14	84⅜"	97⅛"	65"										16½"	25⅜"	22½"		
211A-15	90"	102¾"	65"										16½"	25⅜"	25¼"		
211A-16	95⅝"	108⅜"	65"										16½"	28⅛"	28⅛"		
211A-17	101¼"	114¼"	65"										13¾"	22½"	22½"	22½"	
211A-18	106⅞"	120⅜"	65"	53⅛"								47⅜"	16½"	25⅜"	22½"	22½"	
211A-19	112½"	139⅛"	65"	53⅛"								53"	13¾"	25⅜"	28⅛"	25¼"	
211A-20	118⅛"	144¾"	65"	58¾"								53"	16½"	28⅛"	28⅛"	25⅜"	
211A-21	123¾"	150⅜"	65"	58¾"								58⅜"	16½"	28⅛"	28⅛"	28⅛"	
211A-22	129⅜"	156"	65"	41⅞"	45"							36⅛"	16½"	25⅜"	22½"	22½"	22½"
211A-23	135"	161⅝"	65"	41⅞"	45"							41¾"	16½"	28⅛"	25⅜"	22½"	22½"
211A-24	140⅝"	166⅜"	65"	47½"	45"							41¾"	16½"	28⅛"	28⅛"	25⅜"	22½"
211A-25	146¼"	172"	65"	36¼"	33¾"	33¾"						36⅛"	16½"	28⅛"	28⅛"	28⅛"	25⅜"
211A-26	151⅞"	177⅜"	65"	36¼"	33¾"	39⅜"						36⅛"	16½"	28⅛"	28⅛"	28⅛"	28⅛"
211A-27	157½"	183¼"	65"	36¼"	28⅛"	28⅛"	28⅛"					30½"	16½"	28⅛"	25⅜"	22½"	22½"
211A-28	163⅛"	188⅞"	65"	25"	33¾"	33¾"	33¾"					30½"	16½"	28⅛"	28⅛"	25⅜"	22½"
211A-29	168¾"	194½"	65"	25"	28⅛"	28⅛"	28⅛"	28⅛"				24⅞"	16½"	28⅛"	28⅛"	28⅛"	25⅜"
211A-30	174⅜"	200⅛"	65"	30⅝"	28⅛"	28⅛"	28⅛"	28⅛"				24⅞"	16½"	28⅛"	28⅛"	28⅛"	28⅛"
211A-31	180"	205¾"	65"	30⅝"	22½"	22½"	22½"	22½"	22½"			30½"	16½"	28⅛"	28⅛"	28⅛"	28⅛"
211A-32	185⅝"	211⅞"	65"	30⅜"	28⅛"	22½"	22½"	22½"	22½"			30½"	16½"	28⅛"	28⅛"	25⅜"	22½"
211A-33	191¼"	217½"	65"	25"	22½"	22½"	22½"	22½"	22½"	22½"		24⅞"	16½"	28⅛"	28⅛"	28⅛"	25⅜"
211A-34	196⅞"	223⅞"	65"	25"	22½"	22½"	22½"	28⅛"	22½"	22½"		24⅞"	16½"	28⅛"	28⅛"	28⅛"	28⅛"
211A-35	202½"	229½"	65"	25"	22½"	22½"	28⅛"	28⅛"	22½"	22½"		24⅞"	16½"	28⅛"	28⅛"	28⅛"	28⅛"
211A-36	208⅛"	262"	65"	25"	22½"	22½"	22½"	22½"	22½"	22½"	22½"	19¼"	16½"	28⅛"	28⅛"	28⅛"	28⅛"
211A-37	213¾"	268"	65"	25"	22½"	22½"	22½"	22½"	22½"	22½"	22½"	24⅛"	16½"	28⅛"	28⅛"	28⅛"	25⅜"

A.G.A. Certified as Central Heating Boilers

CAUTION: Water mixing valve should always be installed in the hot water supply to prevent injury.

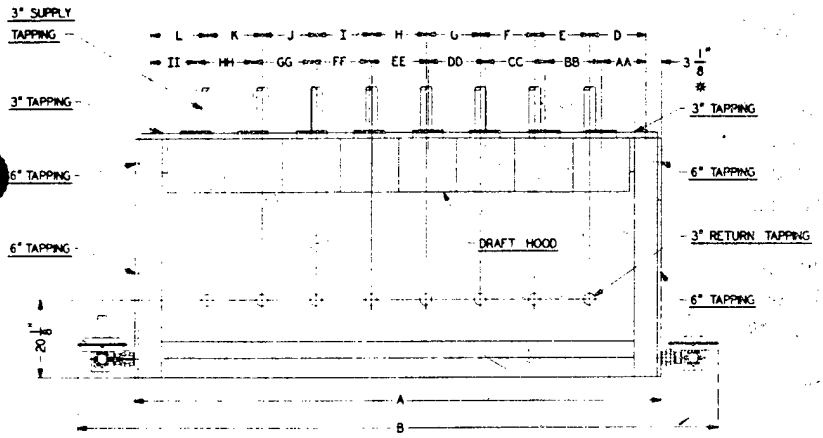
"The manufacturer reserves the right to make changes at any time without notice."

SPECIFICATIONS

(S) Standard (O) Optional (-) Does not apply

Working Pressure PSIG	Water 50	Water 80	Steam 15
Maximum Working Pressure	S	O	S
Cast Iron Finned Water Tube Sections	S	S	S
Gasketed Flow Ports	S	S	S
Insulated Mar Resistant Hammertone Enameled Steel Jacket—Flush Type	S	S	S
Removable End Cleanout Panels	S	S	S
Aluminized Steel Flue Collectors Horizontal To Vertical Draft Diverters	S	S	S
Aluminized Steel Burners	S	S	S

Working Pressure PSIG	Water 50	Water 80	Steam 15
Assembled Gas Control Train to Meet A.G.A.			
Includes: Main and Pilot S.O. Valves;	S	S	S
Main and Pilot gas pressure regulators.	S	S	S
Two (2) Automatic Gas Valves, 120V	S	S	S
IRI and FM Gas Control Trains	O	O	O
Controls 24V	S	S	S
120V	O	O	O
100% Shutoff Electronic Spark Ignition System	S	S	S
Electronic Systems — Natural Gas	O	O	O
E1-M Electronic System — Propane Gas	S	S	S



FACTORY PACKAGES

The series 211A boilers are available as factory packages, completely assembled and wired with all controls mounted in models 211A-04 thru 211A-19. Also available are blocks of assembled sections, preassembled bases with manifold, burners and pilot train for sizes 211A-04 thru 211A-19 (optional).

Literature available

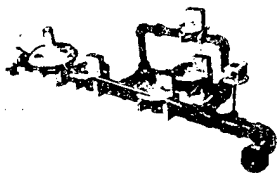
BACK VIEW — DUAL CONTROLS

Controls: End Mounted Standard.

FF	GG	HH	II	Location of Intermediate Tapped Sections Counting from Left (Steam Only)	Center Line of Intermediate Tapped Sections Measured from Left Side of Block (Water Only)			Location of Intermediate Tapped Sections Counting from Left (Water Only)
			10⅞"		BOILER MODEL NUMBERS			
			13⅜"		211A-04W TO 211A-28W INCLUSIVE			
			16½"		DO NOT INCORPORATE			
			10⅞"		INTERMEDIATE TAPPED SECTIONS			
			13⅜"					
			13⅜"					
			16½"					
			10⅞"					
			13⅜"					
			13⅜"					
			16½"					
			16½"					
			13⅜"					
			13⅜"	10				
			13⅜"	10				
			13⅜"	11				
			16½"	11				
			13⅜"	8-16				
			13⅜"	8-16				
			13⅜"	9-17				
			13⅜"	7-13-19				
			16½"	7-13-20				
22½"			13⅜"	7-12-17-22				
22½"			13⅜"	5-11-17-23				
22½"			13⅜"	5-10-15-20-25	53⅛"	109⅜"		10-20
25⅛"			13⅜"	6-11-16-21-26	58¾"	115"		11-21
28⅛"			16½"	6-10-14-18-22-26	53⅛"	120⅝"		10-22
22½"	22½"		13⅜"	6-11-15-19-23-27	58¾"	126¼"		11-23
22½"	22½"		13⅜"	5- 9-13-17-21-25-29	70"	137½"		13-25
25⅛"	22½"		13⅜"	5- 9-13-17-22-26-30	47½"	92½"	143⅛"	9-17-26
28⅛"	25⅜"		13⅜"	5- 9-13-18-23-27-31	47½"	98⅛"	148¾"	9-18-27
28⅛"	28⅛"		16½"	5-9-13-17-21-25-29-33	70"	115"	160"	13-21-29
22½"	22½"	22½"	13⅜"	5-9-13-17-21-25-29-33	70"	115"	160"	13-21-29

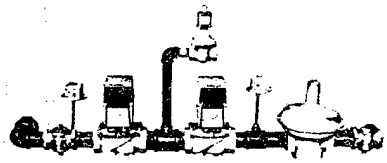
NOTE: In areas having hard water, water with high oxygen content or other unusual water condition, the use of Direct Hot Water Supply Boilers should be considered only with proper water treatment.

OTHER OPTIONAL EQUIPMENT



MOD-U-PAK CONTROL SYSTEM

The Mod-U-Pak system provides three stage modulation of gas input to the boiler as required to meet heating requirements and outdoor temperature changes, with a minimum of gas consumption providing efficient system operation.



INSURANCE CONTROL SYSTEM

Complete systems to meet insurance requirements, IRI, FM, IRM, etc. are available. Consult factory for information.

ELECTRONIC CONTROLS

A variety of Peerless Electronic Control Systems are available. These include prewired control panels with multiple signal lights and switches to suit application. Refer to FSP and ECP literature.

Working Pressure PSIG	Water 50	Water 80	Steam 15
High Limit Control and Operating Control	S	S	S
Theraltimeter	S	S	—
Steam Gauge	—	—	S
A.S.M.E. Pressure Relief Valve, 30 PSIG	S	O	—
A.S.M.E. Pop Safety Valve, Side Outlet Type	—	—	S
Low Water Cutoff Float Type	—	—	S
Low Water Cutoff Probe Type	O	O	S
Gauge Glass And Fittings	—	—	S

TANKLESS WATER HEATER APPLICATION

Boiler Model No.	Heater No. X-1051 GPM	Heater No. X-1052 GPM	Two Heaters No. X-1051 GPM	Two Heaters No. X-1052 GPM
211A-04W	5.5	—	Only one water heater can be used on these models because of boiler length	
211A-05W	6.0	8.0		
211A-06W	6.5	9.0		
211A-07W	7.0	10.0		
211A-08W	7.5	11.0		
211A-09W	8.0	12.0	16.0	—
211A-10W thru 211A-15W	8.0	13.0	16.0	26.0
211A-16W thru 211A-46W	8.0	13.0	Only one water heater can be used on these models. Boiler sizes require piping greater than 2-3" taps	

Water heater ratings are based on constant demand—
40° F to 140° F rise with 200° boiler water